SCIENTIFIC AMERICAN

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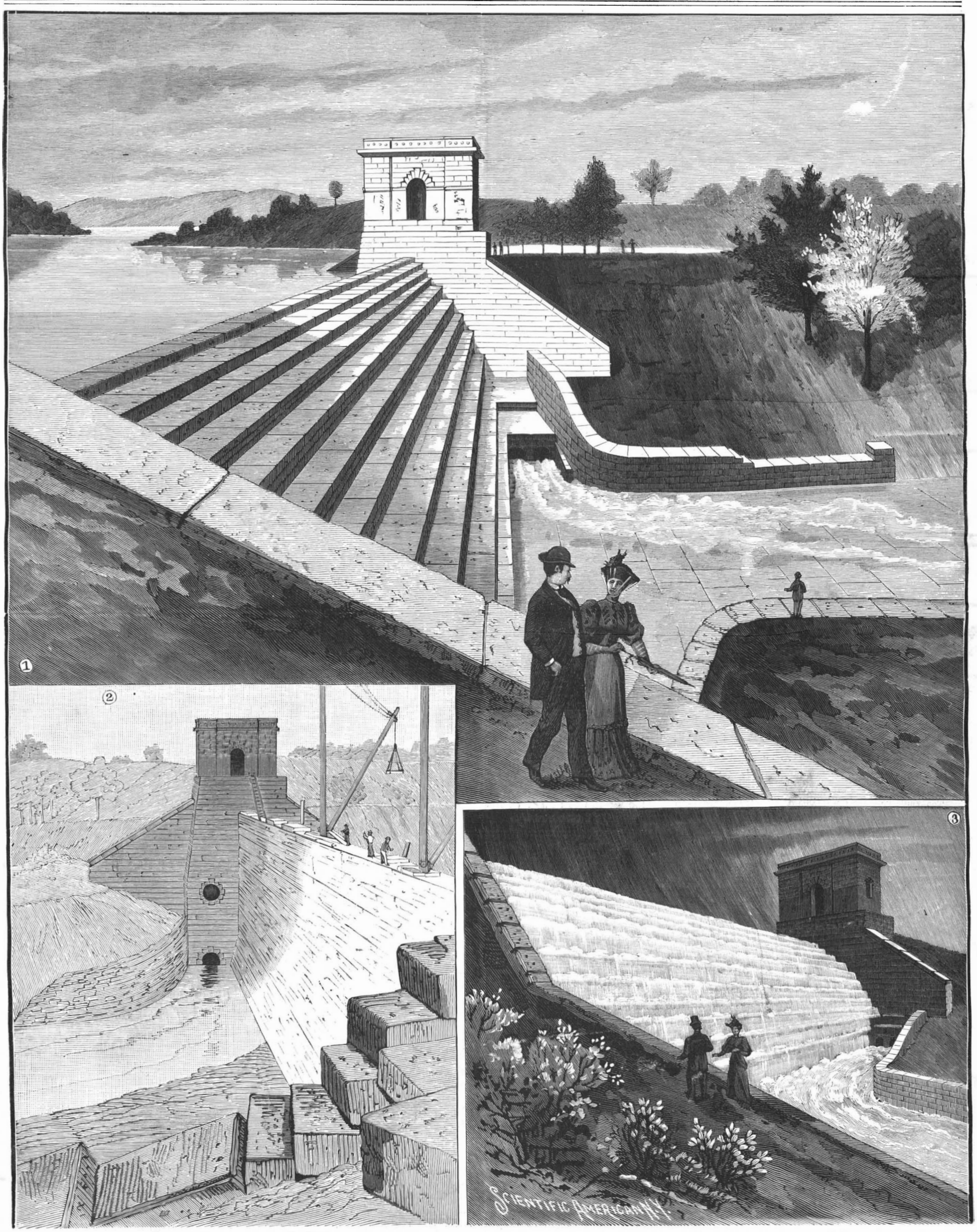

THE WATER SUPPLY OF NEW YORK CITY—THE CARMEL DAM AND RESERVOIR.—[See page 279.]

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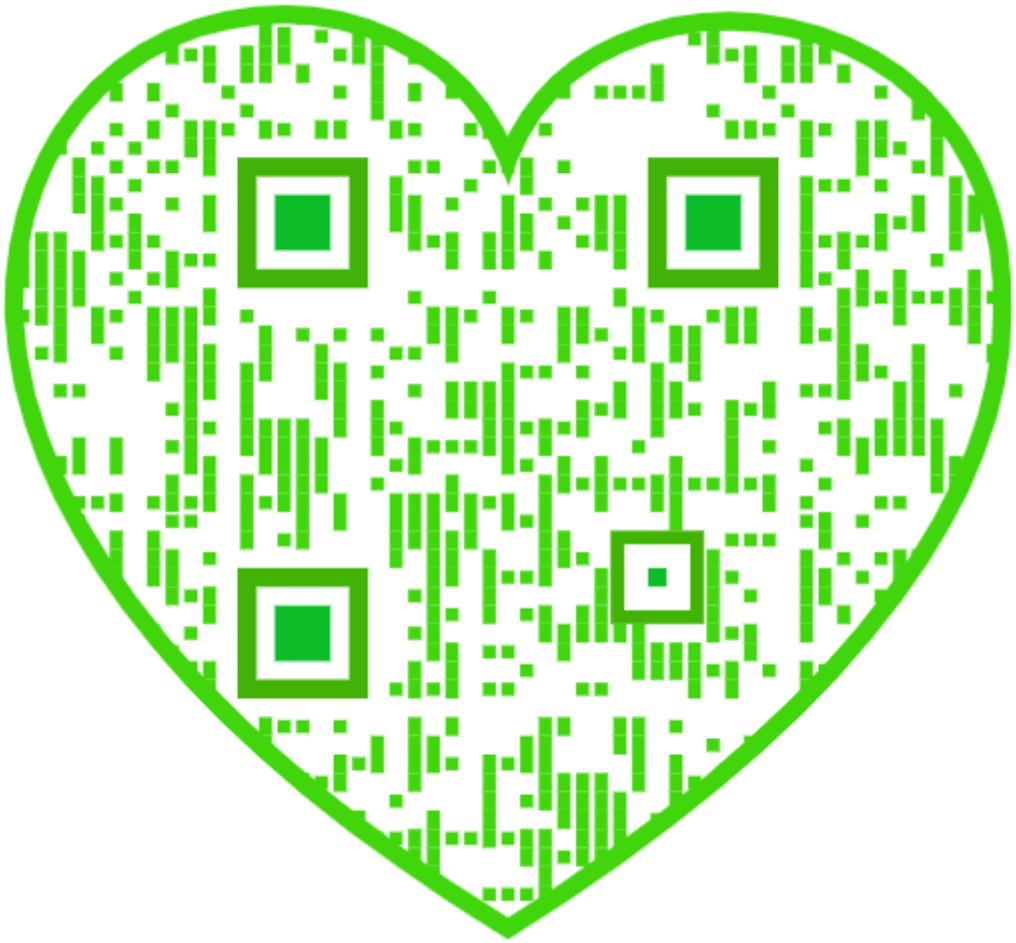

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THE AEROPLANE IN THE PATENT OFFICE.

Since the days of Deucalion man has always desired to fly. Leaving out of consideration mythical accounts of flight, the first successful venture was that due to the invention of the balloon. The Montgolfier balloon established the possibility of flotation. But this is not flight. The dirigible and self-propelling balloon has not yet attained practical success. But self-propelling flying machines without balloons, working on the helix or aeroplane principle, are common, at least in the shape of toys. The aeroplane has been the subject of some very curious investigations by Prof. Langley, of the Smithsonian Institution, and Hiram Maxim, in England, has constructed a flying machine of full working dimensions. Our readers have been kept fully informed in these matters. In the SCIENTIFIC AMERICAN and SUPPLEMENT the most recent developments in aerial navigation have been presented, and but a few weeks have elapsed since we chronicled the last trial of the Maxim machine, at which it actually left the lower tracks and executed flight for a short distance.

Mr. Maxim naturally desired to secure a patent in the United States, and, regarding his complicated machinery as a unit, wished to patent the whole as a flying machine. But the Patent Office objected, and, refusing to take his view, stated that a number of distinct applications should be made to cover the devices used.

Much against his will, the inventor altered his application, and while still applying for a fundamental flying machine patent omitted much which he felt should be included. But he ran against another obstacle. The examiner, after noting that the application had been restricted to cover the air ship alone, notified the applicant that a working model was required. This was reasonable enough perhaps. But the next statement of the examiner, one absolutely committing in its tenor, states that "It is held that the invention is incapable of practical operation, since, without the assistance of a gas field or equivalent the device will be incapable of ascension." By the curious expression "gas field," a gas bag or balloon is meant. Mr. Maxim has criticised the action of the Patent Office very severely in the London Engineering, considerable correspondence has been elicited, and wide publication has been given in the scientific journals to the strictures in question. As Mr. Maxim's air ship represents the most advanced work in aeroplane flight, the action of the Patent Office amounts to a ruling that aeroplane flight is impossible. Right on the heels of this widely published decision comes the account of the trial of July 31, when the machine carrying three people developed so much ascensional power as to break away from restraint and actually to perform a short flight.

In the words of the old story. the flying is all right, the trouble is in the alighting. Meanwhile the Patent Office goes on record as disbelieving in the possibility of aeroplane flight. Langley's and Maxim's experiments carried out by apparatus swept through the air on rotating arms went to prove the possibility which the Patent Office denies. It is bad enough for the inventor to be told that a flying model is required, when the Maxim air ship is such that it can hardly be reproduced in miniature, but it is still worse for the office to go out of its way and state that a "gas field" is required to render the device operative. Mr. Maxim very naturally doubts whether a balloon would remain harnessed to his ship. The theory of action of the aeroplane requires rapid progression, precisely the thing which it is most difficult to obtain with a balloon, and the action of his machine would be most seriously hampered by one.

The air ship must travel forward very rapidly; a balloon would be an obstacle to what may be termed its operative progress. Precisely the thing which the Patent Office declares essential to operativeness would render it inoperative. If a general ruling for aeroplane cases has been promulgated, it should certainly be rescinded as quickly as possible. Otherwise inventors of machines of this class will have to top their structures with a balloon, neither useful nor in accord with the principle of their inventions.

The Institute of Sociology.

The first congress of the International Institute of Sociology assembled on October 1, in Paris.

Sir J. Lubbock, the president, in opening the proceedings, deplored the fact that historians had so much neglected the social side of history. Page after page was devoted to wars and battles and struggles for power, while the social condition of the people was dismissed in a sentence or two. In the course of his address Sir John Lubbock also said:

International associations such as that now founded are of importance from three points of view. The mere fact of bringing together representatives of different nations establishes friendships which do something, and will by degrees do more, to prevent those misunderstandings and misapprehensions which between nations, as between individuals, often are the foundation of grave disputes. In the second place, they bring together men who have devoted themselves to similar studies and give them the opportunity of consultation, of comparing their opinions, and of friendly though critical discussion. Thirdly, they enable each nation to profit by the experience of others. Two dangers which mainly retard our progress and threaten our future are the wars of nations and the wars of classes. As regards the first, our condition in Europe is very serious. Our peace establishments comprise nearly 4,000,000 men; those for war approach 20,000,000. The nominal cost is over £200,000,000, but, as the Continental armies are mostly under conscription, the real cost is much larger. As a consequence of this colossal expenditure the public debt of Europe is continually increasing. This appalling debt is represented by no valuable property, it has fulfilled no useful purpose, but has been absolutely wasted or even worse. Moreover, the economic conditions which necessarily result are very grave. Taxation is increasing, the hours of labor are longer than would otherwise be necessary; all this is a serious reflection, not only on our moral, but on our common sense. In our own case one-third of the total taxation goes to pay for the wars of the past, one-third is spent in preparing for the wars of the future, and only one-third remains for the needs of the country itself. It is impossible for any one to contemplate this gigantic military expenditure without the gravest forebodings. Even if we avoid war, the expenditure must inevitably lead some of the European nations to bankruptcy and ruin. In fact, we never have any peace now; we live practically in a state of war, happily without battles or bloodshed, but not without terrible suffering. In fact, the religion of Europe is the worship of Mars. This state of things is discreditable to a civilized continent. There may be some excuse for barbarous tribes who settle their disputes by brute force, but surely we who pretend to be civilized should aspire to a better system of settling international questions. We have such a system, namely, the principle of arbitration, and I hope we may adopt it more and more.

Another form in which the demon of war threatens the future is the struggle of classes—not only that for higher wages, not merely that as it is called between capital and labor, as if capital could be utilized without that most exhausting form of labor, the labor of the brain, but as we have seen in several cases lately between different trade unions. This is, if a less bloody, not a less deadly form of human contest. In England we have suffered greatly from strikes, and I doubt whether the workmen have not suffered more than the employers. No doubt wages have risen, but it has been questioned by high authorities whether they would not have risen still higher if there had been no strikes. Lord Armstrong has pointed out the effect strikes have had in discouraging manufacturing enterprise, and thus diminishing the demand for labor. I believe that most manufacturers would agree with his view. Among domestic servants and in many parts of the country in the case of agricultural laborers, though there are practically no unions and have been no strikes, the rates of wages have equally risen, and the conditions of employment have been substantially improved, and this although the agricultural interest has been very much depressed. The ordinary boards of conciliation, however valuable, have one great defect, that the interests of employers and employed are, at least in appearance, directly opposed. We have, however, in London organized a conciliation board, which is ably presided over by Mr. Moulton, on a wider basis and one I think more likely to be ultimately successful.

After criticising the various systems of popular representation in vogue, and declaring his belief that in some form or other proportional representation would in time be generally adopted, Sir John Lubbock referred to the great decrease of crime in England under educational influence. He concluded: I am, however, far from thinking that we have yet arrived at the best system of education. It is still too much confined to books and words, and we do not bring our children sufficiently into contact with nature herself. Aristotle well said that "The hand is the instrument of instruments, and the mind is the form of forms," and we must train the hand and the eye, and then train and rely on the memory.

The congress continued its sittings on October 2 and 3, when papers were read by M. De l'Estrade on the division of the soil, by M. Enrico Ferri, an Italian deputy, on socialism, and by M. Rene Worms on science and art in sociology.

The Temps, discussing Sir J. Lubbock's address, expresses surprise that the spread of education has reduced crime in England, whereas in France it has had a contrary effect.

GARDENING for women is engaging attention in Germany, and a horticultural school for girls and women is about to be opened at Berlin. The principal is Fraulein Elvira Castner, who first mooted the idea in a paper read before the Berlin society, Frauenwohl. It is proposed to teach all branches of gardening, and to devote special attention to the production of fruit.

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Unwelcome Discoveries.

Modern science has made many a wonderful discovery, but unfortunately not all of its discoveries are welcome. It has revealed the beautiful processes of nature, but it has also revealed her destroying agencies. The more closely man has studied, the more complicated has he found conditions and the more dangers has he recognized. Where all is outwardly lovely, he has found inward harm. The microscope has disclosed minute horrors, none the less horrible because minute. The telescope, as it sweeps the heavens with its far-seeing eye, has foretold stupendous catastrophes. Much that was thought beneficial has been proved dangerous, and much that was thought harmless has been proved fatal. It has been demonstrated that hand in hand with benefits stalk injuries. Great good is always attended by satellites of little evils.

Years ago people lived in calm confidence that whatever is, is right. They had faith in all things. To-day people have faith in nothing. They are like pilgrims walking through the valley of the shadow of death, feeling thick about them horrors they could not see. They have learned that the very air, once considered a life-giving nectar, is peopled with ferocious microbes seeking whom they may devour. They imagine their insidious enemies perched on restaurant chairs, sitting atilt on the passing coin, flying from shoulder to shoulder in the jostling crowd. They have learned that the water they drink swarms with life and carries germs of dread disease. They have learned that one article of food is bad for the nerves, another heats the blood, another is hard to digest, and so on through all known menus. They have learned that imperfect sanitation and ventilation endanger health, and that proper conditions are, moreover, very rarely attained. Nor is it in everyday affairs alone that science has pointed out the dangers that await man. Through all the realm of human interests it has conjured up evils. Its warning cry runs the gamut of calamities from the danger of not exercising enough up to the danger of the race multiplying too fast for the earth to support it and the equally dramatic danger of the earth flying from its orbit and rushing into the warm embrace of the sun.

Sensitive souls are reduced to a state of abject terror when they think of the small chance man has of life, health, and prosperity, in the face of these ogres of science. What shall they eat, wherewithal shall they be clothed, what can they in safety do, when in all things lurk death and disaster? They dare not indulge their pet weakness for coffee. They eschew their favorite dainties. They fear to come in contact with their fellows or to touch the railing, counter, or car strap, touched alike by all sorts and conditions of men. They fear contagion in the doctor's office and blood poisoning from his knife. They fear a thousand things in daily life. Meanwhile they still live.

Certainly science has evolved much truth, and its warnings are worth the heeding. But the warnings of science, like all other advice, should be referred to a judicious committee on common sense. It should be remembered that doctors sometimes disagree, and the verdict of one authority, or a half dozen, is not necessarily the verdict of science. Moreover, a truth may be too sweepingly applied. Circumstances and individuals differ, and what will hold good in one case needs modification in another. It seems to the hardened and incredulous that if life be really so beset with dangers, it is passing strange that generation after generation should have lived and thrived in their midst, and this also without a knowledge of their existence. If our ancestors, knowing nothing of these wonderful discoveries of hidden evil, managed to avoid the pitfalls, why not we? Does mere knowledge of danger make one more susceptible to its effects? Where is the wisdom that should accompany increasing knowledge? Natural living and confidence in nature are the best safeguards against such evils. Common sense is the best of disinfectants and work the best of remedies.—Minneapolis Times.

Dangerous Chemicals in Photography.

Attention has lately been called to the injurious action exercised by metals on the hands of photographers, which it is asserted may be avoided or the ill effects be at least reduced to a minimum. Thus, in the development of negatives, only the extreme tips of the forefingers and thumbs need be wet with the solution, and then only the front portions of them, where the skin is the thickest; in most instances, in fact, in handling injurious chemicals, it is only when they come in contact with the thinner portions of the skin, as on the back or between the fingers, that any harm results. Briefly, India rubber finger stalls, of but the slightest cost, will perfectly protect the fingers from all pernicious materials, and, being exceedingly thin, are by no means uncomfortable to work in. It is noted, in this connection, that the effect of chemicals is strongly different on different individuals. Thus, an instance is cited of one who had dealt for years, and with impunity, with cyanide of potassium in connection with electroplating as well as photography, but suffered severely from bichromate of potash; another, on whom the bichromate was innocuous, even when used on a large scale, could scarcely touch cyanide without suffering inconvenience—even the smell of the substance subjecting him to nausea and headache.

The Earliest Electric Passenger Boats and Passenger Cars.

The earliest passenger boat propelled by electricity is believed to have been that of Prof. Jacobi, of St. Petersburg, Russia. In 1838, on the river Neva, he had such a boat. It was 28 feet long, 7 feet wide, and carried 14 persons. The electric motor was operated by means of 320 Daniell cells.

The earliest passenger car propelled by electricity is believed to have been that of Alexander Davidson, of Edinburgh. It was in operation in October, 1842, and is thus described in the Edinburgh Evening Journal of that period:

"ELECTRO-MAGNETIC RAILWAY LOCOMOTIVE.

"A trial of this very ingenious machine, constructed by Mr. Davidson, was made last month on the Edinburgh and Glasgow Railway, in presence of a number of gentlemen, many of whom were eminent for their scientific knowledge. The construction of the carriage is the first attempt which has been made in this country to apply the powers of electro-magnetism to railway traffic, and from the success which attended this trial, sanguine hopes may be entertained that the period is not distant when it will either supersede, in many cases, the employment of steam, or lend a powerful aid to this mighty instrument in all the operations in which it is at present employed. The carriage was impelled along the railway about a mile and a half, and traveled at the rate of upward of four miles an hour, a rate which might be increased by giving greater power to the batteries, and enlarging the diameter of the wheels. We understand that the carriage was built at the expense of the railway company, and we cannot but congratulate them in having the discernment to employ Mr. Davidson, a gentleman of much practical knowledge and talent, to whose genius great discoveries have been made in electro-magnetism, by whom the carriage was projected, and to whose unwearied exertions the practicability of the scheme is almost placed beyond a doubt.

"The dimensions of the carriage are 16 feet long by 7 wide, and is propelled by 8 powerful electro-magnets. The carriage is supported by four wheels of 3 feet diameter. On each of the two axles there is a wooden cylinder, on which are fastened three bars of iron at equal distances from each other, and extending from end to end of the cylinder. On each side of the cylinder, and resting on the cylinder, there are two powerful electro-magnets. When the first bar on the cylinder has passed the faces of two of these magnets, the current of galvanism is then let on to the other two magnets. They immediately pull the second bar until it comes opposite them. The current is then cut off from these two magnets and is let on to the other two. Again they pull the third bar until it comes opposite, and so on, the current of galvanism being always cut off from the one pair of magnets when it is let on to the other.

"The manner in which the current is cut off and let on is simply thus: At each end of the axles there is a small wooden cylinder, one-half of which is covered by a hoop of copper; the other is divided alternately with copper and wood (three parts of wood and three of copper). One end of the coil of wire which surrounds the four electro-magnets presses on one of these cylinders on the part which is divided with copper and wood; the other end of the coil presses on the other cylinder in the same manner. One end of the wires or conductors which comes from the battery presses constantly on the undivided part of the copper on each cylinder. When one of the iron bars on the wooden cylinder has passed the faces of two magnets, the current of galvanism is let on to the other magnets, by one end of the coil which surrounds the magnets, passing from the wood to the copper, and thereby forming a connection with the battery. This wire continues to press on the copper until the iron bar has come opposite the faces of the two magnets, which were thus charged with magnetism. On its coming into that position, the current is cut off from these two magnets by the wire or rod of copper passing from the copper to the wood, and thereby breaking the connection with the battery. But when the wire or rod of copper leaves the copper on the one cylinder, it leaves the wood and passes to the copper on the other cylinder at the other end of the axle, and in so doing connects the other two magnets with the battery, and they pull the next iron bar in the same manner. At the other end of the carriage there are other four magnets and wooden cylinder, with iron bars arranged in the same manner.

"The battery, which is used for propelling the machine is composed of iron and zinc plates immersed in dilute sulphuric acid, the iron plates being fluted so as to expose greater surface in the same space. The weight propelled was about six tons."

High Voltage Electric Shock Produces Insensibility to Pain.

Dr. P. S. Donnellan, M.D., of Philadelphia, writing to the Medical News, describes a case occurring in the practice of his colleague, Dr. W. M. L. Coplin, as follows:

On the 20th of April, 1894, J. R., aged 44 years, while engaged in repairing broken wires for the Bell Telephone Company, grasped the ends of a wire that had crossed an electric light wire conveying one thousand volts. He received the full force of the current through his body and was immediately rendered unconscious. He was thrown violently to the ground, and could not be released until the current was broken by a fellow lineman, who cut the wires apart with a hatchet.

The man was brought to St. Mary's Hospital within half an hour of the accident, and I saw him a few minutes after his admission. He was in profound coma, with pupils widely dilated and irresponsive to light, breathing stertorous, face pale, and bathed in perspiration. About ten minutes later he vomited, and then became wildly delirious, so that it required the combined efforts of three men to keep him in bed. He moaned and cried incoherently, and tonic and clonic convulsions of a severe type succeeded each other with great rapidity. At this time we were unable to take his temperature on account of his extreme restlessness, but to the hand it appeared about normal. His respirations now lost their stertorous character, and became more of the Cheyne-Stokes variety, averaging about ten per minute for two hours after his admission. The pulse was 80 per minute, of high tension.

The man was given morphine by hypodermatic injection; and as the delirium and convulsions did not abate, the injection was repeated and soon afterward he gradually quieted down. As his respirations were alarmingly feeble, he was given strychnine by hypodermatic injection with excellent effect. He fell into an apparently normal sleep, from which he awoke four hours later, conscious, but slightly dazed, and feeling, as he expressed it, "tired and sore all over." On my visit to the hospital next morning I found that he had slept well during the night; his temperature was 98·8°, his pulse 72, his respiration 18. He complained of pain from a number of severe burns that he received during his contact with the wire. These burns were distributed irregularly in lines over the back, arms, and legs, and evidently were caused by the intensity of the current, as the clothing which covered the affected areas showed no signs of having been scorched.

On questioning the patient as to the nature of the accident, he remembered perfectly all of the incidents of his morning's work up to the time that he grasped the wire that conveyed the shock through his body. After that moment he had not the slightest knowledge of what had occurred, and did not suffer the least pain until he awoke at 6 P. M., as already stated, to find himself in bed in the hospital. The patient made an excellent recovery.

In view of the employment of electricity by the authorities of certain States for the purpose of putting condemned criminals to death, the facts of the case related are of interest.

In another case elsewhere, according to the statement of our patient, he was absolutely insensible to pain from the instant he received the shock; even the actual discharge of the current caused him no suffering; and were it not for the burning of his skin, he would not have been aware that he had met with an accident.

While it is to be regretted that the public is greatly exposed to accident from contact with currents of high tension on account of the almost universal employment of electricity as a motive and lighting power in our large cities, it seems to me that, so long as capital punishment has to be enforced as a legal penalty, the electric current, properly applied and of sufficient high tension, is the most humane agent yet devised for putting condemned criminals to death.

Shortsightedness.

In the public schools of France 24·2 per cent of the scholars are shortsighted, in those of Germany 35 per cent, and in those of the United Kingdom 20 per cent. The percentage of myopy is highest in the classes of rhetoric and philosophy. The hygienic condition of the school does not seem to affect it, but in the opinion of Dr. Martin, a French authority, want of physical exercise is the chief cause of it. By modifying the work of the classes, and allowing reasonable spells of exercise between them, the proportion of myopy in the college of Giessen fell from 26 6 to 17 per cent in five years.

The Great Search Light.

The great search light made by the General Electric Company and which was exhibited at Chicago, afterward at the Winter Exposition, San Francisco, has found a final home and resting place at Mt. Lowe, Cal. It is estimated the rays of this wonderful light can be seen at a distance of two hundred miles, when the air is clear.

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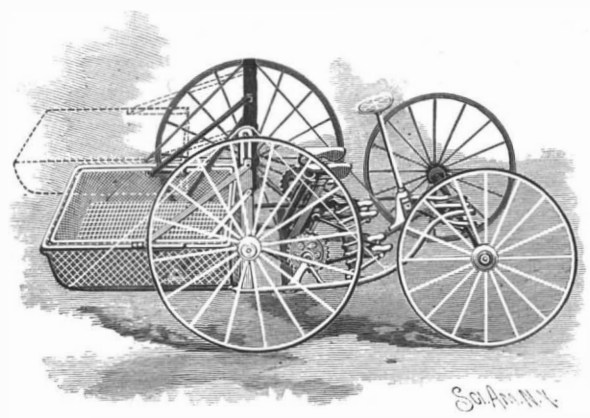
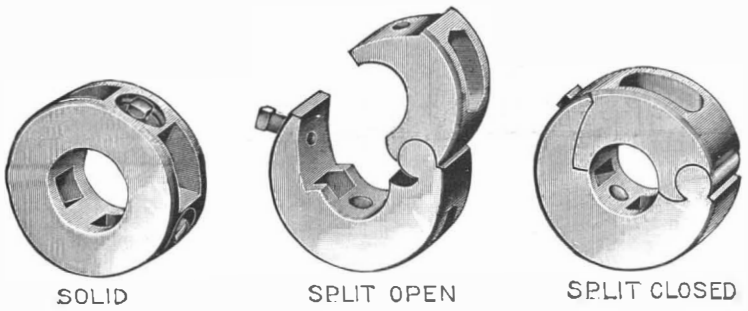
A FOOT PROPELLED VEHICLE.

This vehicle has, behind its rear axle, a compartment for carrying packages, adapting it for the use of tradesmen and others in delivering goods, the central portion of the vehicle being free for the riders and the propelling mechanism. The improvement has been patented by Mr. John W. Cleary, of No. 111 Montague



CLEARY'S FOOT PROPELLED VEHICLE.

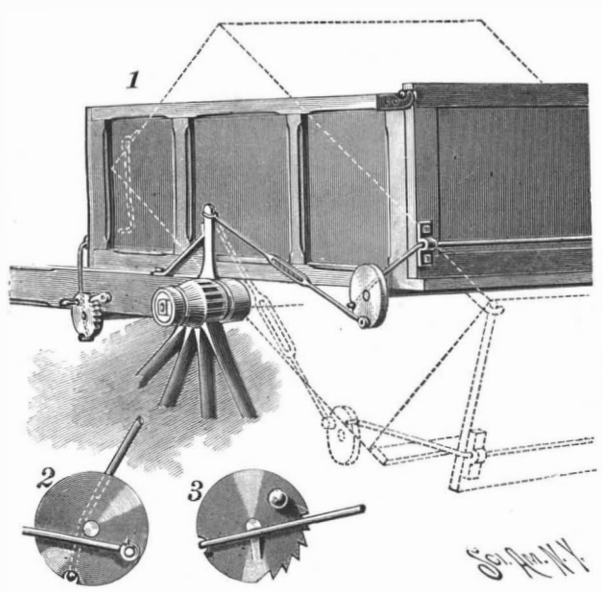
Street, Brooklyn, N. Y. The front axle has a common form of fifth wheel, and is connected by chains with a nearly vertical steering shaft at the top of which is a handwheel. The rear axle is revolved by sprocket chains from a crank shaft journaled in the frame of the vehicle, the cranks on the shaft being connected by pitmen with pedals or foot levers, the vehicle having two seats and four pedals, so that two people may ride and assist in its propulsion. The package carrier consists of two or more parts, the smaller ones when not in use to be nested in the larger one, which rests on the bed of the vehicle, while the movable part of the carrier is supported by two pairs of pivoted arms extending from posts projecting upward from the rear axle. The receptacles of the carrier are preferably of skeleton construction, and have pivotal connection with the arms, and the posts are vertically slotted, to permit the upward movement of the upper pair of arms when the upper compartment of the carrier is swung upward, as indicated by the dotted lines, the pivot pins at the inner ends of the upper pair of arms then resting in offsets of the slots to support the receptacle in raised position. A leg is also pivoted to the under side of the movable receptacle, the raising of the latter allowing the leg to swing into vertical position to form a support for the raised receptacle. The vehicle may thus be arranged to carry a comparatively large amount of goods, in such manner that they may be easily handled.



THE "GIANT" SAFETY COLLARS.

A TAIL BOARD CATCH FOR DUMPING VEHICLES.

The device shown in the illustration securely holds closed the tail board of a cart or car until the latter is tipped downward at the rear, when the tail board is automatically released, to permit the discharge of the load. The improvement may also be used upon a dumping car, when the fastening device is employed to lock the sides of the car. The improvement forms the subject of a patent recently issued to Mr. Henry B. McKee, of No. 695 Willoughby Avenue, Brooklyn, N. Y. Near the lower edge of the tail board are forwardly extending hooks, which may be formed on a single rod, and these hooks engage notches in catch wheels on opposite sides of the cart, the wheels also having pins on which are pivoted the outer ends of extensible rods, whose other ends are each pivoted to an arm on a stationary portion of the cart. The extensible rods normally push on the catch wheels to hold the tail board in closed position, as shown in full lines in Fig. 1, but when the body of the cart is tipped down at the rear, as shown in dotted lines, the catch wheels are turned and the tail board is swung outward. The side rods are made in two sections by means of a yoke in which one section slides against the tension of a spring, to provide against strain or breakage, should the body swing beyond the normal point in dumping. Fig. 2 is a side view of the catch wheel and hook, and Fig. 3 shows the fastening device at the front end of the cart, where a depending hook engages a notch in the catch wheel, and teeth on the wheel are engaged by a pawl on the cart frame, to hold the body of the vehicle in normal position. On this wheel also is a handle, by which the wheel may be turned to bring the hook and pawl in engagement therewith. The device works entirely without friction, and it is not possible for it to catch or bind so that force will need to be used to facilitate its working.



McKEE'S VEHICLE DUMPING DEVICE.

To Walk Properly.

Lippincott's Magazine says: Stride out to your full measure, but don't try to go beyond it; and try not to fall short of it as you go on. Keep the knees as straight as you can conveniently, and this will oblige you to rise on the ball of the foot behind at each step. The calf of the leg is a valuable element in walking, and yet many walkers, by throwing their weight upon the knees and the muscles of the front of the upper leg, lose the push and spring of the calf altogether. Such men habitually stand with knees bent, like a "sprung" horse, and only straighten the knees by an effort. The arms should swing freely, the head should be up and the chest expanded; breathe deep and breathe slow. Few people walk right; yet it is an easy thing to learn, and when it is learned you can walk farther, faster and more enjoyingly than if you do it wrong.

COLLARS FOR USE ON SHAFTING.

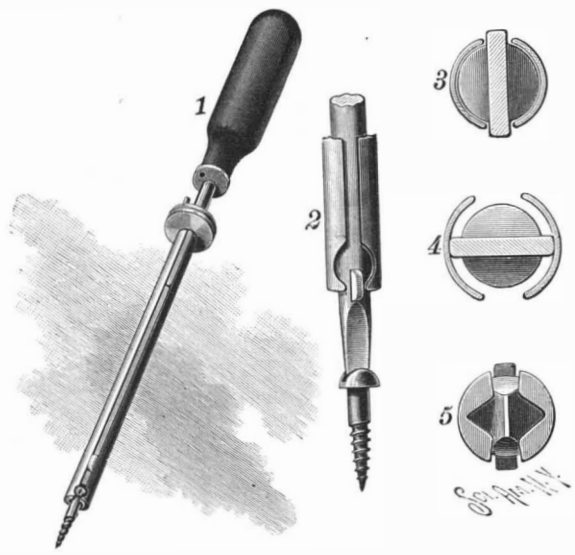
The solid and split collars shown in the illustration are chambered to avoid unnecessary weight on the shaft, while preserving the full bearing surfaces at each end. They are made by the Gouverneur Machine Company, of Gouverneur, N. Y. Owing to their hinge joint, the split collars may be put upon the shaft in a space equal to their length, and when in place the set screw that holds the collar together also secures it in position on the shaft. No bolts are used and set screw heads do not project above the surface.

A TOWER TANK—30,000 GALLONS CAPACITY.

The illustration represents a large tank supported by an all iron four column tower, 63 feet high. It is one of a kind largely used in connection with independent water supplies for protection against fire in mills, factories, warehouses and storage yards. The tower costs much less than such as are generally built, considering its durability and strength, being built after a specially patented design of the W. E. Caldwell Company, of Louisville, Ky., for many years large manufacturers of towers, tanks and tubs. The company make all sizes of tanks, from 300 to 100,000 gallons capacity, and furnish full particulars, with plans and specifications, for building foundations and erecting towers. The latter, it is hardly necessary to say, is a matter to which the best of attention should be given, for 20,000 gallons of water weigh more than 85 tons—50,000 gallons weighing over 200 tons—and any defect in the foundation or structure of the tower may prove dangerous as well as costly.

A SCREW HOLDING SCREWDRIVER.

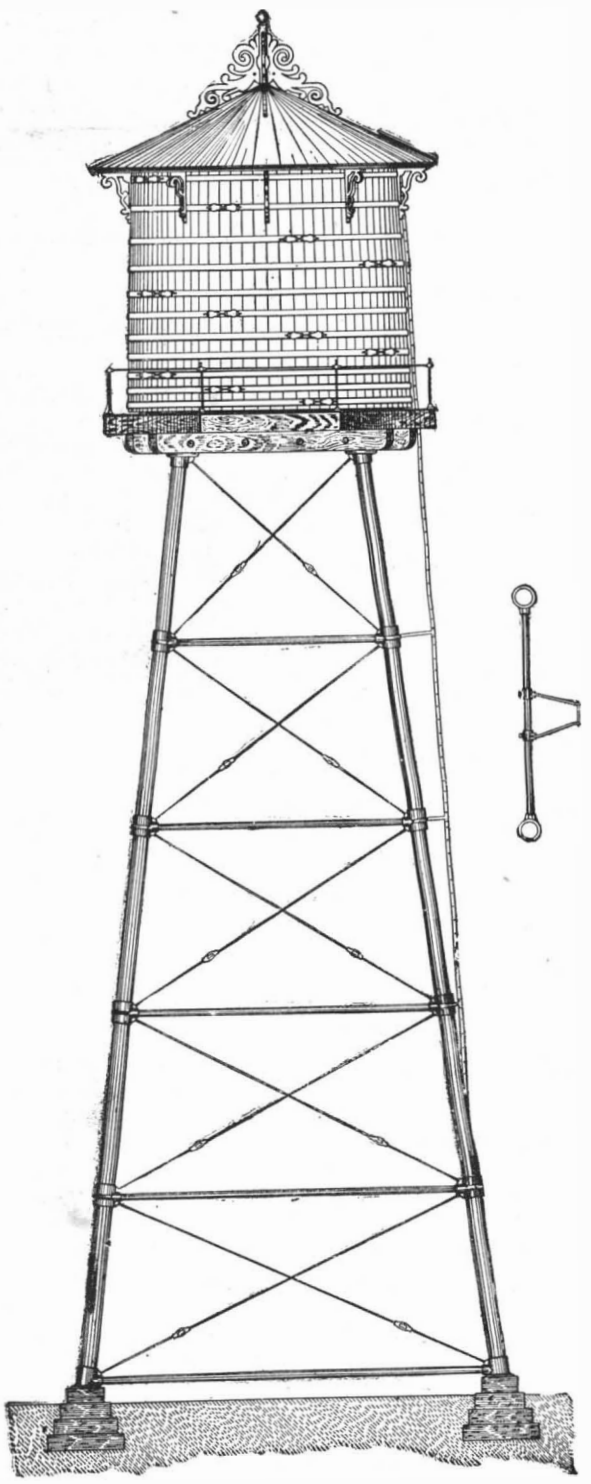
The engraving illustrates a tool designed to temporarily hold a screw and carry it to engagement in the screw hole before screwing it home. It has been recently patented by Mr. Maximilian Keehn, of No. 156 East 112th Street, New York City. In Fig. 1 the tool is represented holding the screw, Fig. 2 showing one end of a sleeve which slides on the shank of the tool, the sleeve having at its inner end a pin engaging a recess in the handle, to prevent the sleeve from turning. The sleeve is split longitudinally, forming pronged ends having recesses for the reception of the screw head, there being also inwardly projecting flanges near the ends of the prongs, as shown in Fig. 5, forming a seat for the head, and also engaging the shank of the screw. Figs. 3 and 4 are transverse sections of the tool and sleeve in engagement with the screw. On the shank of the tool are also cam lugs and notches engaged by the prongs and flanges of the sleeve when the latter is in rearmost position, as shown in Fig. 2, and a spring tongue in one of the splits prevents accidental displacement of the sleeve. With this improved tool a screw may be placed and driven without the necessity of the operator holding the screw with one hand, which is sometimes extremely inconvenient, the conditions of actual practice frequently necessitating the employment of pliers or other devices.



KEEHN'S SCREWDRIVER.

Lead Poisoning from Millstones.

A series of cases of lead poisoning in a family have been traced by Dr. H. Strauss, of Giessen, to the material used in stopping the millstones in which the flour for the bread of the household was ground. The stopping contained a very large quantity of sugar of lead. Dr. Strauss states that a more extensive epidemic of lead poisoning at Chartres about thirty years ago was also traced to the use of a stopping for millstones which contained a large quantity of lead.—Brit. Med. Jour.



AN IMPROVED TOWER TANK.

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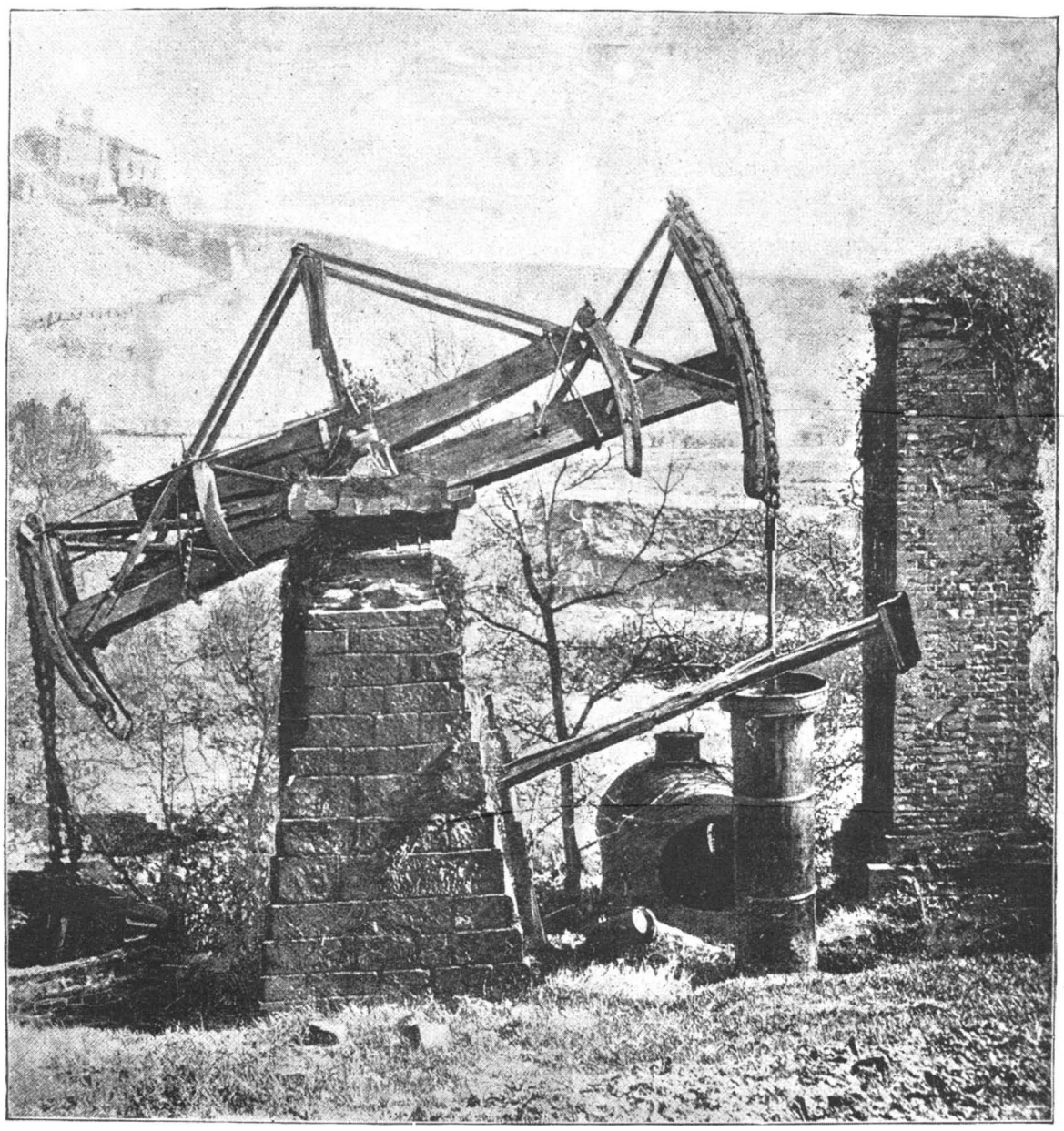
[FROM ENGINEERING.]

A NEWCOMEN STEAM ENGINE.

The steam engine long ago attained the dignity of having a history, and, indeed, an ancient history. It is to be found in museums and collections, and already many controversies have been waged over most points in its early construction. Attempts have been made, by aid of engravings and drawings, to reconstruct some of the earlier examples, so as to give the present generation a vivid idea of the triumphs of some of the great mechanical minds long passed away. Valuable as these full-sized models are, they, nevertheless, lack actuality, and there is always a doubt in the mind of the spectator of their literal accuracy. Far better it is when an actual example can be secured, and preserved for posterity. At the present moment there is a specimen of an engine built by Newcomen, of Dartmouth, in 1705, rusting away in the open air for want of a friendly hand being put forth for its preservation. It was brought to our notice by Mr. Bryan Donkin, to whom its existence was disclosed by Mr. Samuel Fletcher, of Ashton-under-Lyne, and we have pleasure in presenting our readers with an engraving showing its condition a year ago (since then the beam has fallen over). For years the engine was looked upon as one of James Watt's first productions, but recent inquiries leave no doubt that it is a steam motor of the Newcomen pumping type, single-acting. Nothing is known at all trustworthy as to its history. There are a few old residents in the neighborhood who remember its being occasionally, though not regularly, worked some 60 or 70 years ago (1834) for pumping a mine, about which time it seems to have been allowed to fall into disuse. The date of its erection in Fairbottom Valley, half way between Ashton-under-Lyne and Oldham, is uncertain, but it was probably toward the end of last century. It is still on the original site. The engine consists of a solid masonry pillar, 14 ft. 6 in. by 7 ft. 3 in. at the bottom, carrying the beam, which is made of oak, 12 in. by 14 in., braced together with iron, and has segmental ends with the balance weight at one extremity and the piston at the other. The beam, about 20 ft. long, rocks on two trunnions resting on the central masonry pillar, and the piston and pump rods are attached to it by chains. The cylinder, of cast iron, is about 27⅜ in. in diameter and about 6 ft. stroke, the steam entering only at the bottom. It is cast in one piece, 8 ft. 9 in. from flange to flange, and about 1¼ in. thick. As there was no separate condenser, condensation was effected by injecting water into the cylinder by a motion from the beam. It is impossible to say whether there were any rings round the piston, as it has not been taken apart, but probably there were none. A method often employed for keeping the joint of the piston good was to place horse dung on the top, but other materials that retained moisture, such as turf or tow, were also used. The valve gear was off a few years ago, and the pieces were lying about, but they probably could be collected. The wrought iron boiler, of the wagon type, is in a very bad condition; it is believed to be of a more recent date than the engine, and that the original was a haystack generator.



AN OLD NEWCOMEN STEAM ENGINE.

The width of the boiler is 6 ft. 3 in. at the widest part, and 5 ft. 7 in. at the narrowest, the height being 7 ft. There is a steam dome 18 in. in diameter by 14 in. deep, with an 8 in. steam pipe leading vertically out of it. There are five plates in the circumference of the boiler, and 12 rings of plates in its length, the average size of plate being 19 in. by 3 ft. 6 in. The present thickness of the plates varies from $\frac{5}{16}$ in. to zero. The pitch of the rivets is 1½ in. to 2 in.

It appears probable that this is the oldest engine in existence, but it is in a most dilapidated state. Having been so long exposed uncovered to all weathers, the beam has nearly fallen on its side, and the boiler is worn away till it is no thicker than paper in parts, with many holes. The grievous condition of neglect and disrepair into which the engine has fallen is an object of much concern to the people in the neighborhood, who would gladly co-operate in efforts to save it from rot, rust, and total destruction. The engine is the property of the trustees of the late Earl of Stamford and Warrington.

Peach Culture in Belgium.

The United States consul at Liege, in his last report, says that the kingdom of Belgium, after supplying a population of 500 to the square mile, exports 105,000,000 lb. of fruit. Last year the markets were glutted, and the value of foreign shipments rose to about £600,000. A very large proportion of the fruit shipped consisted of peaches, and of the finest varieties. In fine soil, and in situations protected from the north and northeast winds, peach trees, grown from the seed, have occasionally borne fruit; but to ascertain the best stock upon which to bud, a long series of experiments were tried and tried again upon all the varieties of prune, apricot, sweet and bitter almonds--every tree, indeed, of a kindred nature—till the conclusion was reached that the best stem for grafting is the red plum. This hardy plant, whose roots spread wide and strike deep, imparts much of its own vitality to its foster scions. Grafting or budding is done out of doors, so as not to soften the young tree by accustoming it to unnatural conditions. The next question to be considered was that of soil. In sandy and dry earth it was found that neither the plant nor the peach flourished, the one being spindling and the other small; while in rich and moist alluvial soil the tree prospered at the expense of the fruit. A calcareous soil, neither wet nor dry, is preferred by the peach, the young trees requiring a great deal of lime. As it is impossible to tell, without chemical analysis, the exact amount of this element contained in any given quantity of earth, its application must be more or less experimental. The rule in Belgium is to first thoroughly fertilize the soil with manure, and then, after planting the tree, to add a peck of lime to every cubic yard of earth, placing it near the surface. As it is necessary to loosen the earth for at least six feet square and three feet deep, this quantity—a bushel to a tree—may seem large, but the authorities are all agreed that more rather than less would be better. The application should be repeated every three years. Turning from the standard tree, which too often failed to be profitable, Belgian agriculturists experimented with espaliers, or wooden railings, but these were found to be so open and exposed that the young trees fared very little better upon them than in the orchard. They next tried the wall, not as in some countries where mural inclosures are built at great expense for the special protection of delicate fruit, but the sunny sides of their houses, and this met with such astonishing success that there are few houses to-day in Belgium upon whose southern exposed sides trees are not trained. No chateau is too grand, and no cottage too humble, to furnish them protection and support. Consul Smith says that last summer he saw ripening upon the gable end of a town house, a surface of about thirty feet square, over 2,300 peaches, and every one of them larger than a hen's egg. There were four trees, two of them with dwarf stems, not more than 12 inches high, and branches 6 feet long, radiating like the ribs of a fan, and two "riders," or bushes grafted upon tall stocks, whose boughs began to spread where the others terminated. At the time of flowering, it is always necessary to shield the buds from the action of frost, and this is done by various methods, the best of which experience has shown to be the placing, among the upper boughs of the trees, of branches cut from other green trees. This plan has been attended by good results, though it should be employed with great caution, as too much shade is apt to stifle the germs, by excluding the rays of the sun. Another method, until recently very much in vogue, and always effective, is the employment of mosquito netting, or other cheap material with meshes large enough to admit the free passage of light and air. The old custom of using closely woven cloth, like table or bed linen, at night, and removing it in the morning, is said to be more dangerous than the frost itself, as the trees at this season cannot be deprived of air without serious injury. In addition, this artificial heat at night, succeeded by the warmth of the sun, hastens their blowing, when the object is to delay it as long as possible. Shading at noon is sometimes as essential as covering at night. The poor succeed very well in protecting their fruit, by placing a number of horizontal poles about 18 inches apart, and from 4 to 6 inches from the trees, and covering them with light wisps of straw. In good situations, penthouses will sometimes suffice to protect the fruit; in any case, they are extremely useful in checking the flow of sap. Since 1876, the following addition to this method has made assurance doubly sure: A fringe, made of unthrashed rye straw, by tying the cut ends of the stalk together with twine or cord, six or eight in a loop, with spaces of about 3 inches between the wisps, is attached to a pole and suspended under the eaves of the penthouse and in front of the trees. The texture being open, it does not prevent the light and air from reaching the buds. These shields are usually placed in position about the 1st of March, and are not removed, except in cloudy weather, until all danger from frost has passed.

The Advantages of a Fad.

The man who undertakes to cultivate some fad like the growing of plants, the raising of fish, photography, entomology, boating, bicycle riding, athletic sports, microscopy, painting, drawing, music, fishing, hunting, and a thousand and one other things which may come under the head of personal recreation, has always something within his reach which makes him independent of the outside world. The boating man is forever "feeding" his canoe or yacht with paint or varnish and fittings of his own invention. The mineralogist has an endless pleasure in arranging his specimens and in obtaining those which are new. The sportsman fights his battles o'er again, and the fisherman attends to his tackle and invents "facts" to illustrate his next year's exploits. All harmless amusements, but more valuable than gold, because they take a man away from himself.—Business.

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New Railway to London.

The Manchester, Sheffield, and Lincolnshire Railway Company is proceeding to work on the various sections of their new extension to London. The contracts have all been let, and the work of clearing the large area scheduled for the London terminus in St. John's Wood will be put in hand immediately. This particular portion of the new enterprise will be one of the most extensive London clearances of recent years, no less than sixty acres being set apart for passenger station, goods yards, and approaches in Marylebone.

Coming from Finchley Road and Marlborough Hill, the new railway will run, chiefly in tunnel, beside the Wellington Road, and so underneath a corner of Lord's Cricket Ground and the Clergy Orphan Schools, across the Regent's Canal. Here the width of 124 feet, which the new line will occupy from Finchley Road downward, will spread out over an extensive tract bounded on the west by Grove Road, on the north by North Bank, on the south by Broadley Terrace and Boston Street, and to the eastward approximately by the Park Road. An offshoot will spring from the west side, running up to Carlisle Street. Here will be situated a coal station which, it is anticipated, will absorb a great deal of the London coal traffic which nowadays centers so largely at King's Cross. The company looks forward with much satisfaction to the future of these new coal sidings; a satisfaction, it is scarcely necessary to say, not at all shared by the inhabitants of this shortly to be metamorphosed neighborhood. To any one who is acquainted with the grimy purlieus of King's Cross and Battle Bridge, the alarm felt by these folk will not seem uncalled for.

Another offshoot springs from the southern side of this large area, and runs in a long and narrow strip through Blandford and Harewood Squares to the Marylebone Road. This is the site of the passenger terminus, which it is intended shall be fronted by a large hotel, after the manner of Euston and St. Pancras Stations. Alpha Road, South Bank, Boscobel Gardens, Princess Street, Omega Place, Blandford Square, Harewood Square, and a number of smaller thoroughfares will be demolished; and a new road of the commendable breadth of 60 feet will be formed from the Park Road to Lisson Grove, through Boston Street and Broadley Terrace. Another new road will be formed on the next side of the passenger station, running from the Marylebone Road and joining the other new thoroughfare at the point where the goods yards will commence.

Snake Poison.

This is the subject of an interesting article in Science Progress, by Prof. W. Halliburton, from which we make extracts as follows:

The most important class of chemical substances with which the physiologist has to deal is that of the proteids. Their importance arises from the fact that they form the most essential of the constituents of a diet, and the most constant and abundant of the materials obtainable from protoplasm and living structures generally. In spite of this, however, we know practically nothing of their chemical constitution. The physical properties of the proteids, their identification by chemical tests, their subdivision into classes according to their solubilities, and the products of their decomposition have all been pretty thoroughly studied; there also exist various theories of the way in which their molecule is built up; but there is nothing certain at present.

Not the least strange of the many puzzling facts in connection with the proteids is that many of them are poisonous. The poisonous proteids are not distinguishable by any well-marked chemical or physical properties from the non-poisonous or food proteids. When the idea of a proteid poison was first mooted it was received with incredulity; and it was suggested that the real poison was something adherent to the proteid, and if the proteid had been prepared in a pure condition, it would be found to possess no toxic properties. This hypothesis may be correct, for the methods at present in vogue for obtaining pure proteids leave much to be desired. These methods, however, improve year by year; but as they improve, the toxic power of the poisonous members of the albuminous group does not diminish, and it appears more and more certain that it is the proteid itself which is the poisonous agent.

Proteid poisons have been obtained from both the vegetable and animal kingdoms. Thus among those obtained from plants, one may mention the proteids obtained from jequirity seeds, the proteid associated with or identical with the ferment papain of the papaw plant, and lupino-toxin from the yellow lupin.

The most important of the animal proteid poisons are snake poisons; the proteids in the serum of the conger eel and other fish; and proteid poisons found in certain spiders.

Poisonous proteids are also formed during ordinary digestive processes in the alimentary canal of every one of us from the proteids taken in as food. The peptones and the proteoses or albumoses (intermediate products in the process of hydration of which the terminal product is peptone) are fairly powerful poisons; 0·3 gramme per kilogramme of body weight injected into the blood will kill a dog, producing a loss of coagulability of the blood, a fall of blood pressure, a stoppage of secretions, and ultimately death by cessation of respiratory activity. Normally animals are protected from this poison by the lining membrane of the alimentary canal, so that no proteose or peptone is found in blood or lymph even during the most active periods of digestion. The cells of this membrane possess many remarkable properties, but one of the most important is this power of regenerating albumen from peptone.

Allied to the albumoses of ordinary gastric activity are the similar products produced by bacteria. The way in which bacteria produce disease has long been a matter of dispute, but the problem appears to be approaching solution. Pathologists have at last turned their attention to the chemical side of the question, and shown that whereas in some cases the poisons produced by the growth of micro-organisms are alkaloidal in nature, in by far the greater number the toxic product is a proteid. The one which is best known, or at least attracted most attention, is the toxalbumose contained in Koch's tuberculin.

The foregoing list is far from complete, but one cannot conclude it without mentioning another class of proteid poisons: these are the nucleo-albumens obtainable by suitable methods from most of the cellular organs of the body. Originally discovered by Wooldridge, they were named by him tissue-fibrinogens, because they possess the remarkable power of producing coagulation of the blood within the blood vessels of a living animal. A very small dose will kill a rabbit or a dog, and death is, as a rule, produced by extensive clotting within the vessels, especially in the veins. Under certain conditions, however, especially in the dog, they produce the opposite result, namely, a loss of coagulability similar to that produced by peptone. Wooldridge termed this the "negative phase of coagulation."

A practical outcome of all this work is the discovery of alexines or protective proteids. These appear to belong to the nucleo-albumen class also. In small doses they confer immunity on animals to larger doses of similar poisons, and thus the long hidden secret of the modus operandi of vaccination and other forms of protective inoculation is at last beginning to be unraveled.

I propose in the remainder of this paper to consider one class only of the poisonous proteids: those which are secreted by snakes.

Dr. C. J. Martin is to be congratulated on his results, especially as the investigation was fraught with difficulties. It was impossible to procure the services of a professional snake catcher, and so it was necessary for him to do all the work himself. As he puts it, it was also necessary to overcome that dislike and dread of the serpent which is instilled into the youthful intelligence at an early age in every Christian land.

The method of obtaining the poison was an ingenious modification of that adopted by the Indian snake men. The yield of poison per bite was very small, and so considerable time and patience were consumed in getting enough material to work with.

The small quantity secreted is apparently amply atoned for by quality, the minimal fatal dose per pound weight being considerably less than that given by the Indian Snake Commission for the cobra. Some idea of this virulence may be gathered from the fact that one-thousandth part of a grain invariably kills a rabbit of five pounds weight in about a hundred seconds.

This extraordinary toxicity becomes more astounding still when we consider that the poison is a proteid undistinguishable by chemical methods from those daily used as food by all of us.

The first investigation into the chemistry of the snake poison of any importance was by Prince Lucien Bonaparte on the poison of an adder in 1843. He found that the activity of the poison was associated with that portion precipitated by alcohol; and he gave the name "viperine" to this precipitate. Dr. Weir Mitchell next turned his attention to the subject about 1860; and he is essentially the founder of our present knowledge concerning snake poison. Crude as were the methods of animal chemistry in his day, they nevertheless led him to the right conclusion that the toxic principle of the venom is albuminoid in nature. He termed it "croatalin" in the case of the rattlesnake. From that time till 1886, in conjunction with Reichert, he continued his work, and confirmed his general conclusion in the case of other North American snakes. About 1871 the Indian snakes received their share of attention; and the names of Sir Joseph Fayrer and Dr. Lauder Brunton are associated with valuable researches concerning the venom of the cobra, kraits and the Indian viper.

In the researches on the venom of the Australian black snake, Martin and Smith found it necessary to exclude various classes of poisons, as well as to determine positively the nature of the venom. They excluded in the first place by appropriate experiments the presence of micro-organisms, ferments, alkaloids, ptomaines, and crystalline acids. In the second place they showed that the poison was a proteid. The methods for the separation of proteids from one another are highly technical. It will therefore be sufficient to say that the manipulations were of the most recent and perfect kind, and pass to the results obtained. In the proteid mixture three proteids were obtained: one an albumen, and the other two albumoses. The albumen is not virulent, but the two albumoses (corresponding to proto and hetero albumoses of Kuhne) are extremely poisonous. They each have the same physiological action, and this is the same as that produced by the venom itself.

The most marked of the local effects is œdema; the general symptoms consist of twitching and convulsions in non-lethal doses. A fatal dose kills within a few seconds or minutes.

The conception put forward of the formation of these albumoses is the following:

The cells of the venom gland by a vital process exercise a hydrating influence on the albumens supplied to them by the blood, the results of which influence are the albumoses found in the venom. The difference between this process and digestion by pepsin or by anthrax bacilli is that the hydration stops short at the albumose stage, and is not continued so as to form peptone or simpler nitrogenous products like leucine, tyrosine or alkaloids. Gland epithelium is certainly capable of exercising such a hydrating influence; the conversion of glycogen into sugar by the liver cells is one of the best known examples.

Fontana, more than a hundred years ago, noticed that the blood remained fluid in animals dead of viper bite, and Brainard, writing forty years back, states that when death occurred immediately in animals bitten by rattlesnakes the blood was found at the post mortem examination to be clotted; but if some time elapsed before the animal succumbed, the blood remained fluid in the vessels. The continued fluidity of the blood has since then been noted by numerous observers in the case of various snakes.

This residue must then be examined for phosphorus. Snake venom contains no nucleo-albumen; and its action not only opens a novel aspect of the subject of snake poisoning, but also sheds light on the vexed problem of blood coagulation.

The smallness of the dose suggests that the injected material does not contribute itself to fibrin formation. Probably it acts by producing disintegration of the cells in proximity to the blood stream, such as the endothelial cells lining the vascular system. If it thus liberates nucleo-albumen from these, the conditions would be practically the same as if this toxic agent were injected from without. The venom is capable of playing havoc with the cells. This was originally shown by Weir Mitchell and Reichert.

Whether the venom causes any destruction of the white blood corpuscles is doubtful. These are massed together in such a way that their enumeration becomes a difficult matter.

The Origin of "Sprue."

Surgeon-Captain Dyson, while officiating for the Sanitary Commissioner of Bengal, has arrived at the conclusion, as the result of his investigations at Darjeeling, that hill diarrhœa is attributable to the mechanical irritation set up by small particles of mica in the water, which cannot be dissolved by any of the acids contained in the gastric juices. The Times of India adds that it thinks this explanation consistent with the symptoms of the disease, and that it may in all probability be accepted as the true one. Although it is, no doubt, true that minute particles of mica are found in the drinking water at Darjeeling, and that their presence may cause irritation and give rise to disease or diarrhœa, we can hardly believe that this explanation will apply to all the cases of this form of diarrhœa met with at different stations in India and in China, the Straits Settlements, and elsewhere. The disease has too wide a range of prevalence, its symptoms are too definite, and it continues too long after the subjects of it have left the places and climates where they contracted the disease for it to be accounted for in this way. It is not uncommon for persons, on first arriving on the hills from the plains of India, to suffer from diarrhœa and to recover without leaving their station; and it sometimes happens that others who have not been on the hills are attacked with a very similar if not identical complaint, and occasionally the symptoms of the disorder in question do not manifest themselves until after individuals have returned to this country. It can scarcely be that the geography of "sprue" is everywhere conterminous with the presence of mica.—Lancet.

A Gigantic Bird from the Eocene of New Jersey.

A very large extinct bird, about the size of an ostrich, and apparently allied to that group, is indicated by a few remains now deposited in the Yale Museum. These fossils are in good preservation, and were obtained by Dr. O. C. Marsh several years since in the upper marl beds, of Eocene age, near Squankum, N. J.

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THE WATER SUPPLY OF NEW YORK CITY—THE NEW CARMEL DAM AND RESERVOIR.

We recently illustrated the new Croton dam, operations upon which are now progressing, and which, when finished, will give a storage reservoir for the water supply of New York of vastly increased capacity compared to the present Croton Lake. Owing to the great height of this dam the water in the Croton River will be backed up by it for miles to the northward, the northern limit being in the vicinity of the Croton Falls, almost on the boundary line between Westchester and Putnam Counties.

The Croton River and its tributaries and branches extend to the northward from this point, and we have already illustrated dams in process of construction for impounding water near the sources of the river. On the West Branch of the Croton, in Putnam County, is situated Boyd's Corners Reservoir. The West Branch flows hence to the southeast and joins the main stream at Croton Falls. A few miles up the stream from the falls and near the town of Carmel, in Putnam County, work is now rapidly approaching completion which involves the construction of two dams to impound the overflow of the West Branch of the Croton River, after it has left Boyd's Corners Reservoir. These dams will establish a reservoir of a very large capacity, and will create a most important addition to the supply of water, for while in some seasons water runs over the dam at Croton Lake and escapes into the Hudson, in spite of the great draft made upon it by the city aqueducts, yet at other seasons the water in Croton Lake falls below the crest of the spillway and the visible supply of water there decreases. For such service as this the reservoirs to the northward are utilized, and by opening the gates at the Boyd's Corners Reservoir, or any analogous one, such as Sodom or Carmel Reservoir, when completed, an increased flow of water is sent down the river bed into the Croton Lake. The Carmel Reservoir, with its approximate capacity of 9,000 millions of gallons, will soon be available for this use. The present Croton Lake has a capacity of only 2,000 millions of gallons.

The new Carmel dam is so far north that the waters of the new Croton Lake, as established by the Cornell site dam, will nowhere approach it, a distance of nearly five miles intervening between the northern limits of the future Croton Lake and the Carmel Reservoir. But long before the large lake will be in operation, the Carmel Reservoir will be filled and ready for use, so that its capacity will very soon be added to that of the existing Croton Lake and other storage reservoirs.

In the present paper we give some of the most impressive features of the main dam, for there are two; one an earthwork dam with no spillway, termed the auxiliary dam, and the other the main dam, which we illustrate. The main dam is a compound structure of masonry and earthwork. Its shape is peculiar. Starting with the northern end, a portion of it runs approximately southwest; it then bends so as to run nearly north and south, and on this portion the overflow is situated, which lies directly over the natural channel of the West Branch. Finally the dam bends sharply back to the west for a distance of a little more than 100 feet and terminates. The extreme length of the dam in its three sections is 1,800 feet. The masonry dam proper is about 300 feet long, 260 feet of which are devoted to the spillway. The surface of the water which it will impound will be 502 feet above tide water at New York City. This, of course, is without effect upon the head of water admitted to New York, as that is fixed by the reservoirs and other works in the immediate vicinity of the city. The foundation courses of the spillway of masonry are set for a depth of 10 to 15 feet, into a trench excavated in the rock; a smaller central trench excavated along the bottom of the large one receives a species of toe to increase the grip upon the rock. The extreme height of the spillway is 74 feet, the crest of the earthwork rising 15 feet higher. The outer slope of the spillway is divided into steps over which the water will flow in a series of cascades. The gate house stands upon one side of the spillway. For outlet, the gate house machinery controls two 48 inch iron pipes, which, running through the dam, partly in a pipe vault and partly in the earth, are carried to a point about 20 feet distant from the extreme base of the dam, where they empty upon the upper part of the apron. Thence the water runs some 15 miles through the river bed to the Croton Lake.

The upper cut shows the spillway with the gate house in the background. On the left is seen the new lake or reservoir full of water, while the two pipes are delivering water from the reservoir upon the apron. The lower right hand cut shows the spillway again, but in operation, water flowing over it and down its steps, and rushing over the apron. The left hand cut shows the interior of the dam and illustrates the progress of operations. The two outlet pipes at the gate house are also shown.

The earthwork portions of the dam, one of which appears in the background of the cut, vary in height. The width at the top of crest is 15 feet. Within it is a masonry core 10 feet thick at the bottom and diminishing at its upper portion to a width of 5 feet 6 inches at the top. This is within 4 feet of the crest of the dam, so that the core rises 9 feet above the water level. The earthwork dam was made in 6 inch layers, which, as fast as laid, were wetted down and rolled. Its inner surface, with a slope of 2 feet to 1, is faced with stone blocks; the outer slope, 2½ to 1, is covered with grass. The country in the vicinity of Carmel has long been a favorite summer resort. The new lake created by the dam will be an additional feature in the landscape. The auxiliary dam is of much the same construction as the earthwork portion of the main dam. It is provided with a single 36 inch blowoff pipe, delivering to a fountain, and which will force the circulation of the water throughout the surface of the reservoir.

In the lake a maximum depth of water of 43 feet is provided for.

Mail, Express, and Freight Service on Street Railway Cars.

The report of the committee on this subject was presented at the recent meeting of the American Street Railway Association at Atlanta by Mr. Richard McCulloch. In order to ascertain how much had already been done in this line a circular was sent to every street railway company in North America. From some of the States, notably Pennsylvania, Rhode Island and Massachusetts, it was reported that transportation of express and freight by street railways was prohibited by State law, and many of the roads stated that their franchises allowed only the transportation of passengers.

In regard to the mail service it was found that 62 street railways are now carrying mail, 58 of which have United States government contracts. Five roads operate special cars for this service.

The only method for handling a large mail service, where it is necessary to collect and distribute along the route, is an independent mail car in charge of a railway clerk. This system is already in use in St. Louis, Brooklyn, and several other places. The best example for such service is that on the St. Louis and Suburban Railway. This road begins in the business part of the city and runs through the best residence and suburban settlements of the town of Florissant, some 16 miles from the center of the city. The mail car makes three trips each day, two to the end of the line and one as far as the city limits. The railway company furnishes a conductor and motorman, while the post office department supplies the mail clerks. The car is specially built for the purpose. The mail is received from the general post office in pouches and delivered to carriers along the route, while mail which has come in too late to be sorted is distributed on the cars to the proper bags. In fact, the service is practically the same as that on steam railways. A light freight business is also done on the car; provisions, light furniture, milk, trunks, etc., are carried and charges collected by the conductor. The car has proved a source of profit to the railway company.

Where the mere carriage of mail in pouches from the main office to branches or from depots to post offices is undertaken, and no attempt is made at collection or distribution of mail along the route, there is no objection to carrying pouches on the front platform, if the number is not too great.

The question of whether or not mail service is called for depends entirely upon the local conditions. One of its advantages is that a fixed income can be assured, as the government contracts generally pay a certain sum per 100 pounds per mile. Another advantage, and one which is of considerable importance, is the prestige of the name of the United States government. The government will tolerate no interference with the distribution of mails, and this may prove a great advantage in the case of strikes and riots.

In regard to express and freight service, 35 roads are now engaged in the express business, while 55 are hauling freight. The distinction, however, between the two classes of service is so ill defined that it is perhaps best to consider both together.

The street railway in many respects is an almost ideal agent for the transportation of packages and light freight, and such a service may well be looked into by street railway managers as a source of profit. As an example of such a road operating express and freight service involving collection and a house to house delivery, the case of the Southern Railway of St. Louis may be stated. The railway begins in the heart of the city and runs a distance of about seven miles through a thickly settled territory. Three trips per day are made on schedule time by the express car. At the down town end is a receiving station where a clerk receives all the express parcels consigned to the company and keeps the books. The delivery is accomplished by means of wagons, two of which are kept at the down town end of the road and three meet the cars at certain points along the line. A charge of ten cents per package is made for this delivery and trunks are taken from houses to the Union Depot, checked and the checks returned for the sum of fifty cents. A corresponding charge, according to size, is made for the delivery of large boxes or bundles. The large dry goods and clothing houses have ceased to run delivery wagons into this part of the city, and now consign all their parcels to the railway company. Several large factories also consign all their freight to these expresses. The railway company assumes all the responsibility of a common carrier.

It may even be advisable to establish an express or freight service as an auxiliary to the passenger traffic, regardless of whether it pays or not; the increased passenger receipts and the advertising given the company may more than counterbalance any loss.

As stated above, the use of a separate car is strongly advocated. A single box car equipped with motors of its own will handle the light freight or express of quite a territory, without interference with the regular running cars. A 25-foot car, equipped with double trucks, supplied with the most approved form of motors and controllers, and fitted up either as a mail car, express car, or a combination of both, may now be obtained for from $2,000 to $2,500, and a smaller car mounted on a single truck can be obtained for less money. If heavy freight is to be hauled, it should be carried in trailer cars built especially for the purpose.

One interesting variation of such a service is that soon to be introduced upon the Union Depot Railroad of St. Louis, for which is now being built a hospital car. This is a 25-foot body double truck car, having a double floor filled with asbestos to deaden sound, and fitted with stretchers, apparatus for heating water by electricity, an emergency drug store, instruments and all necessary apparatus for caring for the sick and injured. A surgeon is to be in charge of the car.

The discussion of the whole question may be briefly summed up in the following conclusions:

1. That a mail service involving collection and distribution is best handled on a separate car, operated on the same plan as a United States railway mail car. 2. That it is supposed that a great advantage arising from the transportation of the mails comes from the fact that the road is under the protection of the government, and is thus secure from riots, strikes, and blockades. 3. That the most promising opening for an express or freight service is a road running between two towns, or a city road running through well populated suburbs. 4. That the question whether or not such a service will pay is entirely a local question, and must be estimated for each road separately, under existing conditions. 5. That there are cases when it would be advisable to operate such a service, independent of the profits, in order to accommodate the patrons of the road and to induce building along the line of the road. 6. That such a service operated upon the ordinary street railway must not be allowed to interfere in the least with the passenger traffic. 7. That in States having laws prohibiting this service, associations of railway managers should be formed to secure favorable legislation.

The Inventor of Phosphorus Matches.

Romer, Preschel, and Irinyi are variously named as inventors of phosphorus matches. From the testimony of a still living college friend, it appears that the real inventor is the Hungarian, Janos Irinyi. It was in 1835 when the latter, then 19 years old and a student at the Polytechnic School in Vienna, attended Professor Meissner's lectures on chemistry. He became greatly impressed by a demonstration of the reaction produced on rubbing together peroxide of lead and sulphur. It struck him straightway that the reaction may be greatly intensified when substituting phosphorus for sulphur. Irinyi was not to be seen at the college for the next few days. His friend wishing to see him called at his rooms, but found the door locked, and on giving his name, received the unmistakable answer: "Geh' weg, Schwab,' ich mach' eine Erfindung." On joining his friends, Irinyi had his pockets full of matches which he struck on the walls, all of them taking fire. He prepared them by melting phosphorus in a concentrated solution of glue, and shaking until the mass became cold and all the phosphorus assumed a finely divided state. This emulsion was mixed with brown peroxide of lead, and sticks previously dipped in molten sulphur were immersed in the mixture. He sold his invention to a merchant named Romer for about 700*l*. Irinyi is said to be still living in the south of Hungary.—E. Jensch, Zeits. angew. Chem.

The Hiccup Nut.

The fruit of this South African plant is locally known as the "hiccup" nut, and by the natives as "Umtandawa." The plant is a climbing shrub with ovate leaves and terminal spikes of dull red flowers. The fruit is an oblong nut with a pleasant flavor, but causes violent hiccough if only a few are eaten. At one time Mr. Wood tried them on himself, and did not care to repeat the experiment. An allied species, C. erythrophyllum, Sond., known as "Umduba," distinguished by its papery, four-winged fruits, and its leaves turning almost white before flowering, but reddish in the autumn, is stated by Mr. J. Kirkman to be used as a medicine by the natives in the dose of one-half ounce or less, but an overdose causes death.

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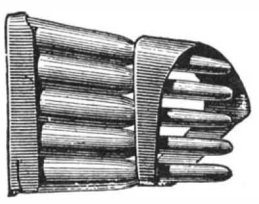
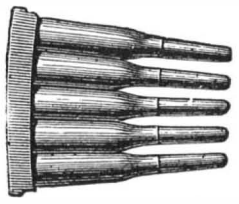
THE MAGAZINE RIFLES OF EUROPE.

Some nine years ago the military world began first to show an active interest in the possibilities of a magazine rifle as a fighting small arm for foot soldiers. The Winchester repeater, of course, was an old friend, and for nearly a score of years before had been favorably known as a serviceable cavalry carbine. One nation, the Italians, certainly, had adopted a species of Winchester, the Vetterli repeater, for special foot regiments; but there were objections on the score of weight and a want of facility in its reloading arrangements, and other reasons against the general adoption of the Winchester as the weapon for marching regiments. Hitherto, therefore, the ordinary breechloader had had to suffice for all armies—each country adopting the type that seemed to suit it best, improving on its own model in detail, from time to time, as became necessary to keep pace with innovations abroad. Thus France, for some twelve years, had rested more or less satisfied with the Gras rifle, Germany with the Mauser, Austria with the Werndl, Russia with the Berdan, and England with the Martini-Henry (as improved on the original type issued to the British army in 1871). It being practically impossible, however, to improve further on the single shooter type of rifle, and each country looking forward, as we continue still to look forward, to the outbreak of a European war in the near future, the idea of a magazine rifle which would give its adopters at the outset a marked advantage of every one else then came into serious consideration. Inventors in various countries almost simultaneously set their wits to work, notably Lebel, in France, Mannlicher in Austria, and Lee in America, with results that we see to-day. The three types which bear the names of these inventors have been accepted since 1886, and are those on which the various magazine rifles now in use all over the world are constructed. The general plan common to all is the fitting to the breech action of the rifle itself of a special mechanism, comprising a "feeder," in which is placed the store of reserve cartridges. The breech action of the rifle automatically works a spring placed in the attached "feeder," which, as each shot is fired, presses a fresh cartridge into the firing chamber by the pulling back and pushing forward of the ordinary loading bolt, which projects at right angles to the stock at the rear of the barrel of the rifle.

The Lebel system may be taken first. For one thing, so much has been heard of it owing to the extraordinary efforts the French army authorities have taken to keep its system to themselves. In the Lebel the magazine is in a fixed tube beneath the barrel, designed to take eight cartridges of the well known modern shape, and of the small caliber necessitated by the important matter of making the rifle light and handy. The caliber of the Lebel bullet is only 0·315 of an inch, penetrating power being specially given to it, as a set off to its lightness, by coating the lead with nickel. The loaded rifle, with its magazine full, weighs 9 lb. 3 oz., and the weapon is sighted up to 2,000 meters, or 2,187 yards. The high velocity of the bullet, the result of the smokeless powder used and the system of rifling, enables the Lebel to shoot at point blank range, that is, without raising the sight on the barrel, up to 700 yards. In this matter of point blank range, however, the other rifles are equally efficient. The mechanism of the Daudeteau rifle, another French invention, and later than the Lebel, the officially recognized design, approximates more to the Austrian Mannlicher system and its congener the improved Mauser magazine rifle of the second or 1890 type. These two weapons are the magazine rifles in use in Austria and Germany. The Mannlicher has a caliber of 0·315 inch, and has its magazine adapted to take five rounds at one loading. The magazine in this case is of the nature of a fixed box in one piece with the trigger guard. The cartridges, held together in one clip or "filler," are pressed down into the breech, the bolt being drawn back to open the breech. Thence they drop into the magazine, where they rest until the bolt is pushed forward to close the breech, which brings the top cartridge into the firing chamber, and sets the repeating mechanism ready to eject the cartridge cases after firing, and to replace them with loaded cartridges jerked up automatically one by one into position by the spring at the bottom of the magazine. The action of the new Mauser closely resembles the Mannlicher, of which system it is an adaptation in all respects. The Mannlicher rifle is sighted up to 2,700 yards, weighs, when loaded, 9 lb. 9 oz., and fires a bullet (cased in steel or nickel) of the same caliber as the Lebel. The new Mauser is a very similar weapon, weighing 9 lb. 8 oz. when loaded (five rounds). It fires a rather smaller size of bullet. The Mauser bullet is only 0·295 of an inch in diameter—about the thickness of an ordinary lead pencil. There remains a final word to be said about the Lee, which is the system we in England have adopted. Our system differs essentially from any used abroad. For in our rifle, the Lee-Metford (Metford being the name of the inventor of the rifling and Lee the inventor of the magazine mechanism), the magazine is detachable, and is merely a thin steel box, which clips into slots under the breech of the weapon, from which it is otherwise separate and distinct. The rifle can thus be used, if required, as a single firer without any magazine being attached. The Lee system further differs from the other European systems in having a "cut-off" arrangement connected with the magazine, to permit of the weapon being used as a single firer while the magazine is attached; the magazine full of cartridges (ten in number) remaining, under these circumstances, on the rifle as a reserve ready to be made use of in an emergency by setting back the "cut-off." One point in favor of the detachable magazine is that, if damaged, it can be replaced on the spot by a new magazine without there being any necessity for sending the rifle to the armorer for repair, as must happen when the magazine forms an integral part of the weapon. The caliber of the Lee-Metford is 0·303 inch.

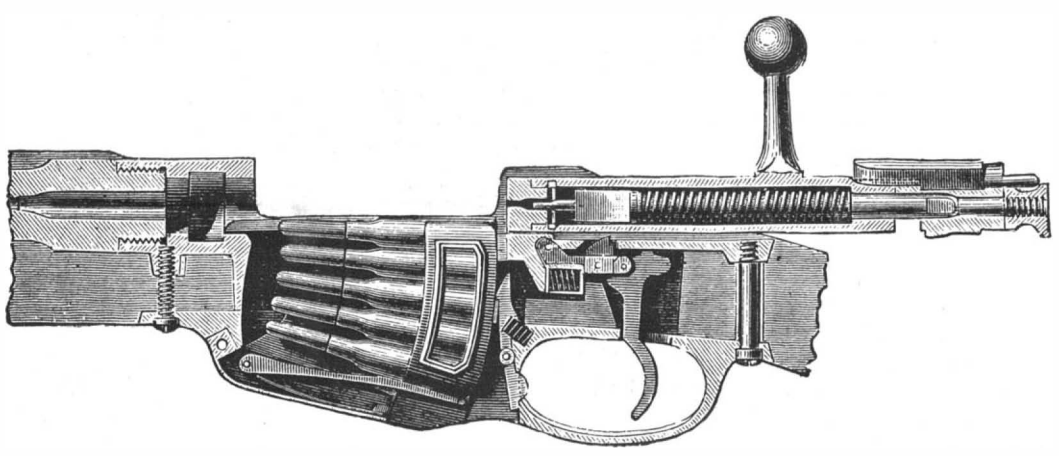


THE CHARGE FOR A DAUDETEAU RIFLE.

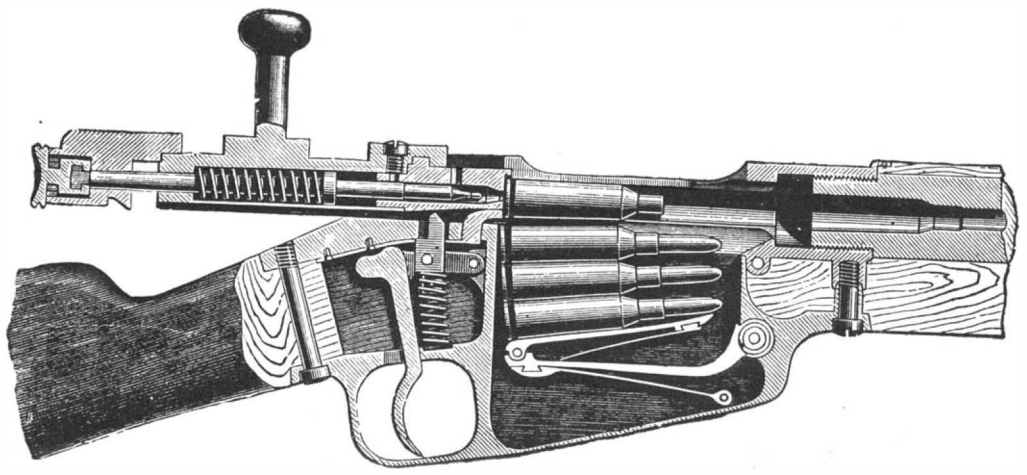


THE CHARGE FOR A MAUSER RIFLE.

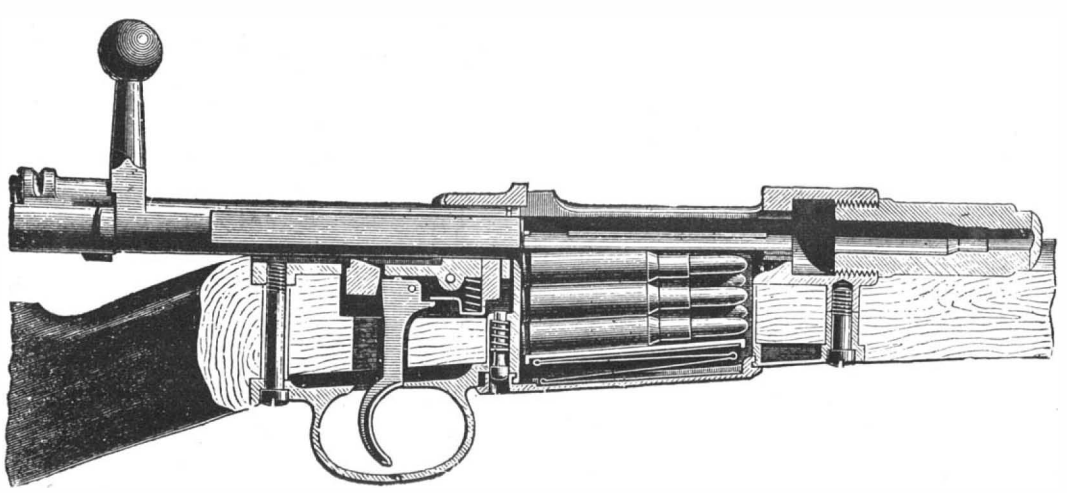
Since the above three types of magazine have been adopted for Europe, Russia and America have introduced combined systems of their own, evolved from comparing the best points of the Lebel, the Mannlicher and the Lee. The Russian arm is stated to be sighted up to three versts, or just two miles. The American arm is known as the Krag-Jorgensen, a five cartridge loader. It is also said to be capable of being sighted up to two miles. Belgium and Turkey have the Mauser, identical in most respects with the pattern of the German weapon. China has the Lee, of a pattern in many details like our own Lee-Metford, but using a much bigger bore (0·433 of an inch). Italy adopts an improved Vetterli, known as the Vetterli-Vitali, a weapon weighing 10 lb. 10 oz., caliber 0·409 of an inch, with a fixed breech-box magazine, like the Mannlicher, taking five cartridges at a time. Switzerland has also adopted the Vetterli-Vitali.—The Graphic.



THE MANNLICHER RIFLE, SHOWING THE CHARGE BEING INTRODUCED AND THE BREECH OPEN.



THE DAUDETEAU RIFLE—THE SECOND CARTRIDGE HAS JUST BEEN FIRED.



THE MAUSER RIFLE WITH THE MAGAZINE CHARGED AND THE BREECH OPEN.

Facts About Wood.

The strongest wood which grows within the limits of the United States is that known as "nutmeg" hickory, which flourishes in the lower Arkansas River. The most elastic is tamarack, the black, or shellbark, standing not far below. The wood with the least elasticity and lowest specific gravity is the Ficus aurea. The wood of the highest specific gravity is the blue wood of Texas and Mexico. The heaviest of the foreign woods are the pomegranate and the lignum vitæ; the lightest, cork. The tensile strength of the best known woods is set forth in the following: Ash, 14,000 pounds; beech, 11,500; cedar, 11,400; chestnut, 10,500; cypress, 6,000; elm, 13,400; fir, 12.000; maple, 10,500; American white oak, 11,500; pear, 9,800; pitch pine, 12,000; larch, 9,500; poplar, 7,000; spruce, 10,290; teak, 14,000; walnut, 7,800; willow, 13,000; lance, 23,000; lignum vitæ, 11,800; locust, 20,500; mahogany, 21,000; maple, 10,500.

The weight in pounds per square foot (without fractions) of the well known woods (dry) is as follows: Butternut, 25; cedar, 35; cherry, 44; chestnut, 38; cork, 15; dogwood, 47; ebony, 83; box elder, 43; elm, 41; blue gum, 52; water gum, 62; white hickory, 49; shellbark hickory, 43; holly, 47; juniper, 35; lancewood, 45; larch, 34; basswood or linn, 37; mahogany, 66; hard maple, 46; white maple, 34; mulberry, 35; white oak, 53; persimmon, 44; pear, 41; pitch pine, 41; red pine, 36; white pine, 34; yellow pine, 33; plum, 49; poplar, 33; quince, 44; rosewood, 45; sassafras, 30; spruce, 31; sycamore, 38; tamarack, 23; black walnut, 41; white walnut, 32; the willows, from 30 to 36; and the yew, 49. Four hundred and thirteen different species of trees grow in the various States and Territories, and of this number 16, when perfectly seasoned, will sink in water. These woods of high specific gravity grow mostly in the arid regions of New Mexico, Arizona and Nevada.

It is proposed to build a ship canal from Lake Erie to the Ohio River. Three routes suggested are from Erie, Pa., to Pittsburg, from Cleveland to Marietta, O., and from Toledo, O., to Cincinnati. Most of the agitation concerns the first named route, for the ship canal idea originated in Pittsburg. The distance is about one hundred miles, and the cost of the canal is estimated at $25,000,000.

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The Position of Women in Africa.

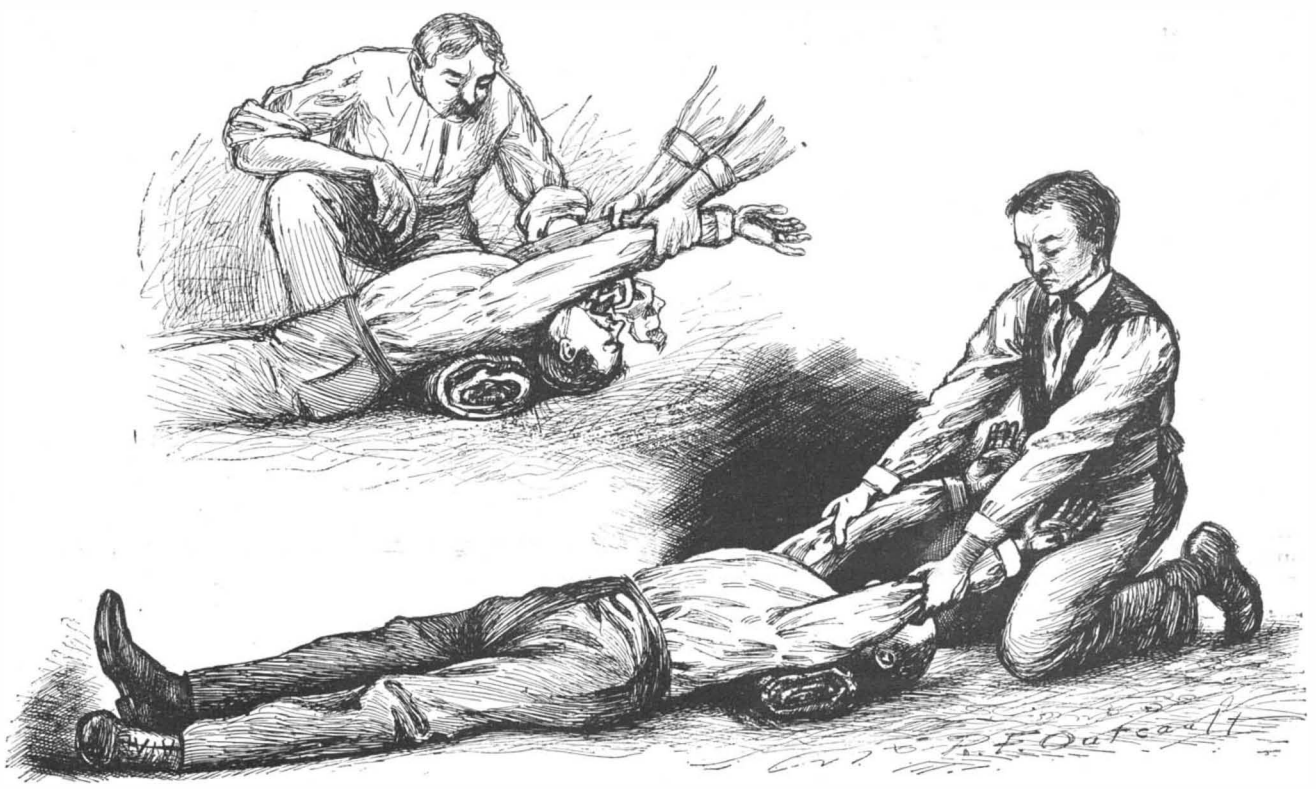
Dr. W. Stoss, in the Frauen Zeitung, Berlin, gives an interesting account of the position of women in Africa. He says:

Among natural people women have to suffer on account of their natural want of physical strength, and this is especially the case among the African tribes, where polygamy adds to the degradation of the weaker sex. But their lot is not without mitigation. It is influenced by the same factor that raises woman to her high position among civilized people—the love of her children. The laws of the barbarous African tribes give much influence to the mothers in regulating heritage and succession, which gives them a more important position in the family and in the tribe. The mothers and sisters of an African chief are often his most influential advisers, even the real rulers. On the whole, however, the old maxim holds good: if the intellectual state of a tribe is very low, their women are treated badly. With the lowest of the African tribes, the Bushmen, woman is nothing but a slave and a beast of burden. During the travels of a Bushman family the wife has to carry everything, and if there is a scarcity of food, the woman has to suffer first. If she becomes weak and old, she is abandoned to the mercy of the wild beasts. Very different is the treatment accorded to the woman of the genuine negro. All things considered, their position is the same as with us. Men and women share in the necessary work. True, if the man thinks fit to beat his wife, no one is likely to interfere. On the other hand, the woman will find the laugh on her side if she succeeds in getting the better of her spouse by a judicious use of her teeth, her nails, and—her tongue.

The Zulus are a patriarchal race. The father is master of the family and owner of its female part; therefore the position of the woman is much lower, if her husband has a high rank. The wives of the chief never take part in his councils and may only move about on their knees before him. The principal reason for this degradation is the custom of selling women. The price varies between ten and a hundred head of cattle for the daughters of a chief. Other women may be had for three or four cows. If the wife does not suit the husband in every particular, then he sends her home and demands another, or else part of the price paid must be returned to him. But if she proves to be specially valuable, the relative who sold her will demand some extra payment. A bad wife may also be sold as a slave.

Among the Dualla tribes, on the west coast, the women have not the slightest vestige of a right. They are sold and resold at the pleasure of the men. They may be given away, lent and hired out. They must do all the work in the fields, and, if they fail to bear children, they may be killed. And yet they often manage to hold their own against their masters. The natural result of their position is that the women combine against their husbands in a most alarming manner. The traveler Bastian tells of a rich man in Okolloma, with whom he stayed for some time. The poor fellow was at loggerheads with his women, and had to barricade his hut at night time. Twenty infuriated women inhabited his place and refused to come to terms.

The importance of the women among the Dahomeyans is well known. Their female warriors were much more dangerous to European troops than the men. The enormous extent to which decapitation was carried on among the Dahomeyans during Behanzin's reign accounts for the great predominance of women in point of numbers. A procession of the king included fifteen of his daughters, accompanied by fifty female slaves, 730 of his wives, thirty Amazons of the bodyguard, six companies of Amazons of seventy each, 350 slaves, and a rear guard of another sixty Amazons—but only 150 male warriors. The influence of the women among these people has been felt by both the Germans and the French in their colonial troubles.



DEALING WITH ELECTRIC SHOCK—FIRST POSITION.

The Russian Pacific Railway.

A length of 2,200 miles is now open and Omsk is now reached by rail. The cost has been about $44,000 per mile. The natural conditions were on the whole unfavorable. The men often had to carry their food with them, and they were not unfrequently compelled to allow themselves to be lowered down in baskets in order to prepare the track. On the section between Ufr and the Sima River there was, between Urakowo and Bulaschawa, a bog of about 60 miles extent, which had been formed through the rain water accumulating in the course of thousands of years in this natural pit of granite. The engineers and the men were for a long time compelled to live in huts, built of earth on crossed piles, which they could only approach in boats. The mosquitoes were another trial, and 4,000 masks had to be procured, in addition to which smoking with juniper was resorted to.

DEALING WITH ELECTRIC SHOCK—SECOND POSITION.

[FROM THE ELECTRICAL WORLD.]

HOW TO DEAL WITH APPARENT DEATH FROM ELECTRIC SHOCK.

BY AUGUSTIN H. GOELET, M.D.

Much interest has recently been excited by the report from France of the resuscitation of a man apparently killed by electricity, and by the announcement of the French scientist D'Arsonval that a person so shocked should be treated as one drowned. The suggestion is a good one but may be somewhat misleading unless understood; that is, unless the person undertaking the resuscitation appreciates what is to be accomplished and just how it is to be done.

As this authority says, an electric shock may produce death in one of two ways, viz.:

1. By producing destructive tissue changes, when death is absolute; or 2, by producing sudden arrest of the respiratory and heart muscles through excitement of the nerve centers, when death is only apparent; in other words, animation is merely suspended. The subject may be aroused from this syncope if efforts at resuscitation are not too long delayed.

The alternating current, which is usually regarded as the most deadly, strange to say, nearly always produces death in this second manner.

To say that a person has received a shock from a wire conveying a current of four or five thousand volts, does not necessarily signify that the body has been subjected to the full force of the current, even if the meter does register nearly one ampere during the time of the accident. In view of the fact that the human body offers a resistance of several thousand ohms, which resistance is greatly increased by imperfect contact, and by charring and burning the tissues at the points of application, it is not often that the internal structures or vital organs are submitted to a very considerable volume of current, though it apparently passes through the body. It must be borne in mind that when the clothing is moist with perspiration or wet with rain, it offers a circuit of less resistance than the human body, and in this event the body receives only a shunt current very much less in quantity than the main current. The bulk of current, in this instance, passes over the surface and does not enter the body. This may explain the survival of some who have apparently withstood very powerful currents. It must be presumed, therefore, that electricity seldom kills outright, though the condition of suspended animation, which it induces, would result in death if not counteracted.

All things considered, it is rational to attempt the resuscitation of those apparently killed by electricity, and if not too long delayed, the effort promises fair chances of success, provided proper means are instituted.

If the body has actually been submitted to a current of sufficient volume to produce destructive tissue changes, all efforts at resuscitation will, of course, be futile.

If, on the other hand, only respiration and the heart's action have been temporarily arrested, there is a condition of syncope simulating apparent death

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by drowning, or from anæsthetics, and the physician knows that patients in this condition are frequently revived. Laymen will appreciate the nature of this condition if it is explained as one of exaggerated faint, and would not feel appalled upon encountering it if previously instructed how to cope with it. In an ordinary fainting spell the necessity to stimulate is universally appreciated. In syncope resulting from an electric shock stimulation is likewise indicated, but more vigorous measures are required. This is the only difference.

As said above, the direction to treat one shocked by electricity as one drowned may be misleading, as the conception of the layman of the necessities in this case would be to roll the body on a barrel. Let him understand that the condition is one of exaggerated faint, that the necessity is for prompt stimulation, and that the quickest and most powerful stimulant which can be employed is artificial respiration. The man must be made to breathe, if this is possible, and efforts to induce respiration must not be suspended until breathing is fully and normally restored or until it is absolutely certain that life is extinct. This cannot be assured in less than an hour's persistent, energetic, tireless effort.

The accompanying illustrations will serve to make intelligible the following directions for artificial respiration:

The body must be placed upon the back. A roll made of a coat or anything else convenient (rolled, not folded) is placed under the shoulders and must be sufficiently large to so prop the spine up as to drop the head backward. The operator should kneel behind the subject's head, facing him, grasp the elbows and draw them well over the head, so as to bring them almost together above it, and hold them there for two or three seconds. Then he carries them down to the sides and front of the chest, firmly compressing it by throwing his weight upon them. After two or three seconds the arms are again carried above the head and the same maneuver is repeated, at the rate of fifteen or sixteen times per minute. At the same time the tongue must be drawn out to free the throat. This manipulation stimulates respiration in the following manner, viz.: When the arms are extended over the head, the chest walls are expanded, just as in inspiration, and if the throat is clear, the air will rush into the lungs. When the arms are brought down to the sides of the chest, compressing it, the air is expelled, just as in expiration.

This is the most convenient and reliable manner of inducing artificial respiration. It is known as Sylvester's method. The operator must, however, appreciate the fact that this manipulation must be executed with methodical deliberation just as described, and never hurriedly nor half-heartedly. To grasp the arms and move them rapidly up and down like a pump handle is both absurd and absolutely useless.

In addition to this, if an assistant be at hand, the tongue, held by a cloth or handkerchief to prevent slipping, should be seized and drawn forcibly out during the act of inspiration or when the arms are extended above the head, and when the chest is compressed it may be allowed to recede. This rhythmical traction upon the tongue is in itself an excellent stimulant of respiration. It acts not only by freeing the throat of the tongue, which may fall back and obstruct breathing, but also by reflex irritation, through the fraenum or bridle under the tongue being drawn forcibly against the lower teeth.

Should these efforts fail to elicit any response or arouse any signs of life, recourse may be had to another method of stimulation by exciting the dormant nerve centers. This should, however, be reserved for the physician, who should always be summoned when it is possible to get one, or should be made use of only by one who realizes the injury that may be done if it is carelessly practiced. Still, when the necessity is great and other means have been exhausted, some risk is allowable.

I refer to forcible stretching of the sphincter muscle controlling the rectum or lower bowel. It is well known to physicians that this muscle is the last portion of the body to lose its sensibility and that by irritating it by forcibly stretching, a gasp will often be elicited from one actually moribund.

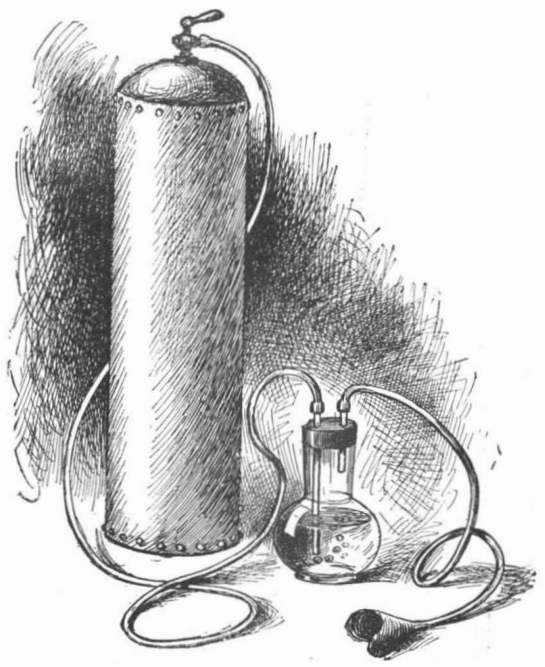
The method of procedure is this:

Turning the patient on the side, the index finger or thumb is inserted into the rectum and the muscle, which, if sensible, will be felt to resist, should be forcibly and suddenly drawn backward, toward the spine. Care must be taken not to introduce the finger roughly or to use sufficient force to lacerate or wound the parts.

Having obtained one gasp, artificial respiration should be continued and a repetition of the proceeding should be reserved until respiration again fails. In some instances, however, it may be necessary to repeat this with every effort at inducing inspiration, that is, every time the arms are extended over the head. The subject then being on the back, the knees are drawn upward to facilitate access to the rectum.

If the accident occurs in a city or large town, oxygen, which may be obtained at every drug store, may be used. This is a powerful stimulant to the heart, if it can be made to enter the lungs.

This gas comes in cylinders furnished with a stop cock and tubes and bottle, which latter is to be half filled with water, through which the gas passes when turned on. (See figures.) If a cone or mouthpiece is not furnished with the apparatus, one can be hastily improvised from a piece of stiff paper and attached by a string to the ordinary mouthpiece. To use the oxygen, place the cone over the patient's face and turn on the stop cock until the gas is seen to bubble freely through the water in the bottle. Efforts at artificial



OXYGEN CYLINDER AND APPLIANCES.

respiration should be kept up while the gas is being administered to favor its entrance into the lungs.

The use of electricity to reawaken the heart and lungs to action offers another auxiliary to the resuscitation process, but implies the skilled employment of special electrical apparatus purely within the possession of the physician, who naturally does not require instruction.

When I was requested by the editors of the Electrical World to contribute this article I gladly accepted because:

1. I am convinced that many who have died in consequence of electrical shocks might have been saved if those at hand had been properly instructed in the methods of reviving suspended animation; and

2. I hope all electrical companies will be impressed with the importance of having their linemen, and other employes engaged in the vicinity of dangerous currents, so instructed and trained that without delay methods of resuscitation can at once be instituted.

Thus the giant Electricity will more surely become

AN IMPROVISED MOUTHPIECE.

man's servant, a faithful and ever obedient one, instead of as now, occasionally, through man's carelessness, his slayer.

The Fear of Death.

Familiarity with death is apt to alter one's earlier conceptions of it. Two ideas are very generally accepted which experience shows to be false. One is that the dying usually fear death; and the other, that the act of dying is accompanied by pain. It is well known to all physicians that when death is near its terrors do not seem to be felt by the patient. Unless the imagination is stimulated by the frightful portrayal of the supposed "pangs of death," or of the sufferings which some believe the soul must endure after dissolution, it is rare indeed that the last days or hours of life are passed in dread. Oliver Wendell Holmes has recorded his protest against the custom of telling a person who does not actually ask to know, that he cannot recover. As that loving observer of mankind asserts, so must every one who knows whereof he speaks assert that people almost always come to understand that recovery is impossible; it is rarely needful to tell any one that this is the case.

When nature gives the warning, death appears to be as little feared as sleep. Most sick persons are very, very tired; sleep—long, quiet sleep—is what they want. I have seen many people die. I have never seen one who seemed to fear death, except when it was, or seemed to be, rather far away. Even those who are constantly haunted, while strong and well, with a dread of the end of life, forget their fear when that end is at hand. As for the act of dying—the final passage from life to death—it is absolutely without evidence that the oft-repeated assertions of its painfulness are made. Most people are unconscious for some hours before they die; and in the rare cases where consciousness is retained unimpaired until a few minutes before the end, the last sensation must be of perfect calm and rest. It is worse than cruel to add to the natural dread of death which oppresses the majority of us while in good health, the dread of dying. There is surely fear enough in this suffering world; let us not increase it by adding imaginary to real causes.—Dr. J. West Roosevelt, in Scribner's Magazine for October.

The Detection of Forgery.*

BY DR. PERSIFOR FRAZER.

I wish to put on record three new methods which I have applied successfully for the purpose of detecting frauds in written documents.

The first enables one to determine with comparative ease which of two crossing ink lines was made first, and consists in observing the crossing by a lens of low power (four or five diameters) at a very oblique angle. If a light ink line be made over a darker one, the appearance to the eye when viewing the crossing perpendicularly to the plane of the paper will be that the darker line is superposed. The reason of this is that ink lines are quite transparent and the darker line is seen through the lighter one and seems to make one continuous line with its two limbs across the intersection. When the paper is inclined, however, but few of the rays of light which reach the eye by reflection from the intersection traverse and lose rays by absorption from both ink films; but the greater number penetrate only the upper ink and do not suffer absorption by the lower.

The second is a method of judging whether or not two lines have been made with the same ink, and consists in passing over each in succession prisms of red, yellow or blue glass (or two of these), and noting the number of millimeters through which it is necessary to move each prism from the position where its thin edge is in contact with the mark to be judged to that where the color is extinguished and the line is black. The prism is pushed horizontally over the ink mark, continually adding to the thickness of the colored glass over the latter. When the line appears quite black the thickness in millimeters over which the prism has been pushed is read off and compared with the number of millimeters which the other line requires to attain the same result. If the inks have the same colors, these results must agree.

Third method. In 1886, I read before the society a paper on the use of composite photography for the purpose of establishing the type of an individual's writing, and especially the signature. Since then the mechanical difficulties in the way have been greatly lessened, and the method has given most valuable results in cases before various courts. But there are many occasions where it cannot be employed for one reason or another, and in such cases I have devised a system of measurement and tabulation which accomplishes by figures what composite photography established automatically by form. The older method may be called the graphic average of the handwriting and the latter the numerical average. The advantage of the former is that it takes into account at once all the elements of character, while the latter can deal only with comparatively few, but in spite of this the results attained have been very interesting.

By the system here alluded to a given number of heights, breadths and angles of letters, and spaces between them and between words, are selected and measured in a large number of undisputed signatures. The same elements are then measured in the signature in dispute. The averages of all the elements in the genuine series is then compared with the latter, and their agreement or disagreement will generally lead to a correct judgment as to the genuineness of the disputed signature.

This method has given successful results in a direction which extends the original idea to a study of "guided hands," and it has been possible to extract from the columns of measurements, proofs of the existence of characteristics of each of the separate handwritings.

* Read before the American Philosophical Society, May 18, 1894.

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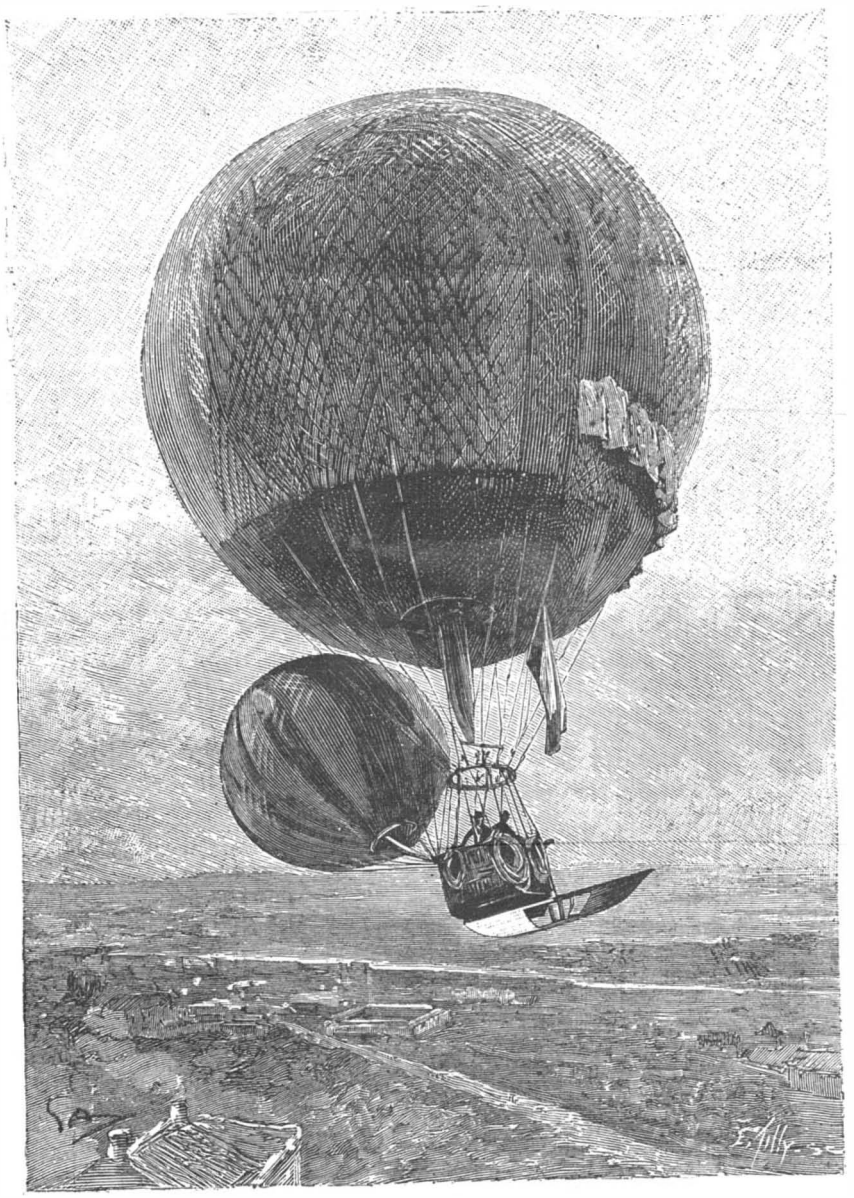
A TOUR OF FRANCE IN A BALLOON.

An interesting experiment in aeronautics was tried in the latter part of September to determine the conditions under which a series of ascensions might be made for a certain number of days, executed successively with the same gas and the same balloon. A series of ascensions were made forming a spiral to the north and northeast of Paris, stops being made at Mery-sur-Oise, Persan-Beaumont, Creil, Mery, Raulat and Essigny-le-Petit. The gas contained in the small balloon which had been put at the disposition of the aeronauts, MM. De Fonvielle and Mollet, by the observatory was used as a feeder to the large balloon, which had a capacity of 1,200 meters. The trip continued for a week. The ascensions were determined by the action of the sun's rays, which expanded the gas and dried the material of which the balloon was made. The descent invariably took place by reason of condensation at twilight. During the entire trip it was not once necessary to open the escape pipe. The balloon carried a horizontal propeller, which was intended to vary at will the altitude of the aeronaut. This apparatus was only used at the ascent from Creil. The results were satisfactory. MM. De Fonvielle and Mollet have now made some necessary modifications, so that the propeller will hereafter be a regular part of the equipment of the aeronaut. Our engraving is from L'Illustration.

Arctic Exploration.

News of the Jackson-Harmsworth Polar expedition has been brought to England by Mr. J. Russell Jeaffreson, who obtained the information at Thorshavn from the captain of the Betsy, a walrus sloop recently returned from her summer voyage in the Barents Sea. It appears that the captain first saw the steam yacht Windward near the well known Matotchkin Schar, where the ice was very heavy, about the middle of August. Returning west toward the end of August he again met with the vessel in latitude 75° 45′ N. and longitude 44° E.; but on this occasion she was steaming in the direction of Franz Josef Land without let or hindrance, the ice being in this locality brashy and rotten, the Windward actually steaming up a lead of which no termination northward was visible. The captain of the Betsy, though unable to distinguish the name of the ship, describes her accurately, and from the positions in which she was seen and the respective dates there is no reason to doubt that his report relates to the Windward. It is worth mentioning that this report is precisely what might have been expected, as Mr. Jackson hoped to find a region of loose, brashy ice about 45° to 50° E. longitude, and after getting abreast of the Matotchkin Schar, intended to make directly for it. The voyages of Mr. Leigh Smith showed that such a condition obtained in favorable years, and the recently published experience of Mr. Arnold Pike, who was yachting in the Barents Sea last summer, testified to a similar phenomenon in a year so unfavorable as the present. This has now been confirmed by the report of the captain of the Betsy, and consequently the outlook for the Windward may be considered very favorable.



TOUR OF FRANCE IN A BALLOON.

Bodily Temperature.

The Kansas Medical Journal has the following to say concerning the temperature of the body:

"It is remarkable what slight variation there is in the temperature of the healthy human body. The normal temperature is 96·6, and it is a fraction less than this one or two hours after midnight; while the maximum temperature occurs from one to two hours after the noon hour. The ingestion of food, fasting, exercise, all are factors in slightly varying the temperature. The great peculiarity about the temperature in men is its evenness under all conditions. Heat or cold causes but slight variation, and in man less than in any other animal. In extremes that would be fatal to many animals, man can endure and enjoy good health under those circumstances. We read of Arctic voyagers enduring a temperature ranging from 80 degrees to 90 degrees and even 102 degrees below zero, while, on the other hand, in the tropics, during the greater part of the year, the temperature ranges from 106 degrees to 110 degrees above, and yet men enjoy health in such varying temperature. We are told that the workmen of Sir F. Chantrey were accustomed to enter a furnace in which his moulds were dried while the floor was red hot and a thermometer in the air stood at 250 degrees F. And Chabert, the fire king, was in the habit of entering an oven the temperature of which was from 400 degrees to 600 degrees F. Such heats are dry, and should the atmosphere be moist and evaporation from the body thus prevented, such intolerable heat could not be endured."

The Apple as Medicine.

Dr. G. R. Searles, of Brooklyn, N. Y., thus discourses on the apple as medicine: "The apple is such common fruit that very few persons are familiar with its remarkably efficacious medicinal properties. Everybody ought to know that the very best thing they can do is to eat apples just before retiring for the night. Persons uninitiated in the mysteries of the fruit are liable to throw up their hands in horror at the visions of dyspepsia which such a suggestion may summon up, but no harm can come to even a delicate system by the eating of ripe and juicy apples just before going to bed. The apple is an excellent brain food, because it has more phosphoric acid in easily digestible shape than any other vegetable known. It excites the action of the liver, promotes sound and healthy sleep, and thoroughly disinfects the mouth. This is not all. The apple agglutinates the surplus acids of the stomach, helps the kidney secretions and prevents calculus growths, while it obviates indigestion and is one of the best preventives known of diseases of the throat. Everybody should be familiar with such knowledge, and I hope you will help disseminate it. In addition, next to the orange and the lemon, it is the best antidote for the thirst and craving of the person addicted to the alcohol or the opium habit."

Antidiphtheritic Serum.

One of the subjects exciting the greatest interest at the recent meeting of naturalists and physicians at Vienna was the treatment of diphtheria by means of a prepared serum. In a paper read by Dr. Behring, the opinion was expressed that the preparation of serum for the purpose should be undertaken by the state, under the direction and control of the sanitary authorities. It was stated that among children the mortality from diphtheria, amounting now to 240 in 10,000, might thus be reduced to one-third of that rate. Dr. Ehrlich spoke of this method of treatment as one of the most important results known in the history of medicine, and he stated that trials made in the Berlin children's hospitals showed that without the use of serum there were twenty-five deaths out of seventy-two cases, while there were only two deaths out of seventy-eight cases treated with serum during the first two days of illness. Antidiphtheritic serum is therefore likely to become an article in demand for medical use, and pharmacists will require to provide for the supply of it.

Camels in Australia.

Some interesting particulars concerning the part which the camel is playing in the development of the Australian colonies are given in the British Australasian dealing with the gold fields of Western Australia. The great central depot for the animals imported from India is Port Augusta, 259 miles northwest of Adelaide, Here a camel quarantine station has been established. and the arrivals are kept in it and carefully watched for the first three months to guard against outbreaks of a certain deadly mange which carried off most of the earliest animals. Once acclimatized, the camels are not liable to the complaint, and they thrive wonderfully upon the natural shrubs of Australia—salt bush, wattle, mulga, acacia, and other varieties. The imported animals, however, are not nearly so valuable as the Australian-bred camels. The pastoralist breeds his camels, as he does his sheep, on scientific principles, so that already, within 25 years, there has been produced in Australia a race of camels "larger in frame, sounder in wind and limb, and possessed of greater weight-carrying capacity than the Indian animals orginally imported." The British Australasian continues: "By means of camel caravans—there are now close upon 10,000 camels at work in Australia—the pastoralists have been enabled to take up and stock new country which was formerly incapable of being utilized, because a broad belt of land that is either waterless or liable to prolonged periods of drought intervened between the good country and the settled regions, whence all supplies have to be drawn, and where all products must be marketed. It is only within the last few years *that* mining men have awakened to the utility of camels in their industry, and large numbers of the animals have lately been drafted to Western Australia. On the older goldfields of that colony the camel caravan has already knocked out the bullock team by reason both of economy and efficiency. But, more important still, the camel is enabling new goldfields to be reached and worked which were previously, if not absolutely inaccessible, incapable of being permanently occupied and utilized. Mining machinery is being made in sections convenient for slinging across the back of the pack animal. Camel wagon transport, unknown both in Asia and in Africa, has also been developed in Australia, the animals being yoked in teams of eight, just like bullocks. Well sinking machinery is likewise being sent into the waterless country on camel-back, and after the magnificent results achieved by artesian boring in the arid region of Queensland, where some of the bores yield 2,000,000 gallons a day and have caused rivers to run where water was never before seen except in the form of an all too scanty rainfall, there is no saying but that by this means the West Australian goldfields, now worked with difficulty owing to the scarcity of water, may be converted into regular oases." During the Lindsay expedition, it is added, the camels had spells of 23 and 21 days without a drink of water.

Heating by Combustion and by Electricity.

Herr A. Wilkie discusses certain experiments made by Mr. J. L. Roberts with the object of ascertaining the comparative efficiency of heating by electricity and by combustion. Mr. Roberts heated masses of metal (rods of platinum and iron) to a red heat, first by combustion methods and then by the electric current When the substance was heated by a flame, the energy expended was calculated from the loss of weight of the combustible and the corresponding calorific power; when electrical energy was used, the energy expended was calculated from the current and voltage. In the first series of experiments, a platinum rod was heated in the flame of a spirit lamp, and also by passing a current through it. When red hot, it was dropped into water. The results showed that less than 0·5 per cent of the thermal energy produced in the flame was transferred to the bar, whereas 90 per cent of the electrical energy appeared as heat. In the second series of experiments, an iron bar weighing about a kilogramme was heated, first by means of well dried charcoal, and then electrically. In the former case, about 0·75 per cent of the thermal energy was transferred to the bar, in the latter case 88 per cent was thus accounted for. These experiments are admittedly crude; but they show that for some purposes electrical heating has claims to consideration.

ONE pound of cork is amply sufficient to support a man of ordinary size in the water.

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The Panama Canal.

The company which has just been formed for taking over the works at the Isthmus of Panama has issued a report, giving. says the Engineer, what it professes to be an accurate idea of the present state of the canal. It had been expected that after being abandoned for nearly five years to the ravaging influences of the floods from the river Chagres, and the growth of vegetation which flourishes with remarkable luxuriance at the Isthmus, the works would have been greatly deteriorated, necessitating perhaps the re-excavating and banking of those sections of the canal already completed. Judging from the report issued by the liquidator, the canal itself has remained practically intact, and the machinery and other plant has only partly deteriorated from the climate.

The first section of the canal, from Colon to a distance of 21·700 kiloms., has been greatly modified by the action of the river which has flowed into it, and after following the incline of the canal for about 5 kiloms., the river deposits a great deal of sediment and turns off into the Rio Mindi, which has considerably enlarged during the past four years. Beyond the point where the Chagres breaks into the canal the works are in very good condition, though they are so covered with vegetation as to be sometimes indistinguishable from the surrounding country, and it is explained that this is one of the reasons why untechnical observers have insisted so often upon the complete ruin of the works. The report urges that, so far from being a disadvantage, this growth has actually been of service in preserving the canal, and the vegetation can be cleared away at very little cost. After the maritime reach, which terminates at 22·500 kiloms., are the works of *the first lock*, and these are in excellent state of preservation. From this point the cutting continues with an embankment 50 meters in height, but notwithstanding the steepness of the sides not a stone has given way, and this is set down to the protection afforded by the dense vegetation. This state of things is unchanged across the plain of Tavernilla as far as kilom. 36; at this point the excavation runs close to the river, from which the water descends during the rainy season. This is particularly noticeable between kiloms. 25 and 28 and between kiloms. 33 and 34. In the middle of the plain of Tavernilla are the large cunettes, which, notwithstanding their steep incline, have been in no way affected by the severe floods of four years ago. The works facing San Pablo are also unchanged, though entirely covered with vegetation. The same condition prevails up as far as the second lock, where the cutting had first been made in view of a level canal, and then altered to meet the exigencies of the plan ultimately adopted.

The canal then follows the bottom of the narrow valley, where it now and then cuts the river as far as the 40th kilom. The result is that the filling-up process has been very active, in consequence of the floods, and the vegetation in this part is particularly luxuriant. At Matachin, where preparations were made for the third lock, the works are often covered with water, but the cutting is nevertheless in a good state of preservation. After Matachin the canal leaves the valley of the Chagres and enters the valley of the Obispo. Here, at the 46th kilom., the works for the fourth lock are in good order, and owing to the uneven state of the ground the canal has a depth in certain places of 44 meters. A little more than a kilometer further on the banking fell in during the work of cutting. From the 48th kilom. a cunette has been made over a distance of several hundred meters through a very hard rock. Then, after passing the works between the Obispo and the Rio Camacho, the valley extends and merges into the plain of Emperador. In cutting through the high ground in this plain the canal has a depth varying from 35 to 40 meters. The fifth lock at this point is likewise in an excellent state.

From kilom. 52·600 are the works of the Culebra, and at one place, where the depth is about 40 meters, the bank has fallen in. Notwithstanding the influx of water, the works are very much in the same state as they were five years ago, though between kiloms. 54·300 and 55·400 the soft soil that had to be cut through has given way. This is due entirely to the action of the water, and it is stated that with proper drainage the difficulty can be overcome. The same influence has been at work on the Pacific slope, where a great deal of shifting soil has been met with. Between the sixth and the tenth lock, descending toward the Pacific, there is nothing worthy of remark, except that the works are very humid and the vegetation is consequently very thick. From the tenth lock the valley opens out in a low, marshy country, and between kiloms. 65·500 and 66·700 the canal has been partly filled up. Further on the canal is in a better state of preservation, owing to the water having a freer course. The maritime channel commences at the 68th kilom. It makes a detour around the mouth of the Rio Grande, and then continues in a straight line until within 200 meters of the northern point of Perico Island. In some parts, where the channel is exposed to the winds, it has been filled up by as much as four meters.

As regards the machinery and other material, the report speaks favorably but sparingly. Of the sixteen dredgers of 120 horse power ten are almost as good as new, and have hardly been used, but the others will require a great deal of repairing. There are several other dredgers, including two marine dredgers and two of the Suez type. All the floating material is found on different points of the canal, principally at Colon and upon the Pacific slope. The rolling stock is likewise distributed over different portions of the canal, and it is not in such a bad condition as might have been expected. Some of the locomotives have been repaired since 1888, and may again be put into service; but many of the wagons have rotted in the destructive climate. In short, it is thought that all the metal plant will be available for use after being overhauled. The wharves at Colon and Boca, the docks and other installations will have to be entirely reconstructed, and repairs will be needed in every direction before the work can be resumed. The railways will likewise have to be relaid; the wooden sleepers are entirely useless, but the steel sleepers are still serviceable. The rails, nuts, and bolts will all have to be replaced. In view of the many costly repairs that will have to be carried out before the work of cutting the canal can be proceeded with, it is difficult to fully understand the project of the new company, whose available capital of not more than twelve millions sterling will be practically swallowed up in preliminary works. It is not pretended, even, that the new company has any definite plan in view.

The first object is to get a few hands at work upon the Isthmus, so as to fulfill the clause of the agreement with the government of Colombia which makes it necessary that the work should be resumed before the end of October, in default of which all the material would be confiscated. When half of the capital has been spent in preliminary works the technical commission will meet to decide whether it is worth while to continue the work, in which event the public will be asked to subscribe about twenty millions sterling. If, on the other hand, it is found inadvisable to pursue the undertaking any further, the money already subscribed will be used for working the Panama Railroad, in which the old company had a considerable interest. So far, no plan for completing the canal has been definitely adopted, and this matter will be left to the technical commission which will be appointed as soon as the company is in working order.

IT is stated that in round numbers there are on all lines of street railways in the United States, 50,000 cars, including steam and electric motors, cable grip cars, trail and horse cars.

RECENTLY PATENTED INVENTIONS.

Engineering.

VALVE GEAR.—Franklin W. Hagar, Nashville, Tenn. This invention relates to marine engines, and the improvement comprises a rocking lever for oscillating exhaust valves, and a rocking shaft journaled in the lever and having an independent turning motion to control puppet valves for the admission of steam, the valves being all contained in a single chest, while a valve link operated from the main driving shaft engages either a pin on the lever or the shaft. The engine cuts off at half stroke, and the cut-off is not adjustable, but is very prompt, the movement being of such a nature that it easily seats the valves, without slamming or knocking.

SPARK ARRESTER.—Henry E. Bultman, Oak Park, Minn. This improvement comprises a lower cylindrical gauze-covered portion attachable to a smokestack and with upwardly projecting and outwardly inclining bars supporting a top band, an exterior funnel-shaped screen having its bottom adapted for attachment to the cylindrical part of the arrester and its upper part bent over the top band and formed into a deflecting cone. The improvement entirely closes the stack so far as the emission of sparks is concerned, but does not interfere with the draught, while an easily actuated cleaning apparatus removes the sparks and thus preserves the life of the arrester.

Railway Appliances.

RAIL TIE.—Jesse C. Cowdrick, Ogdensburg, N. J. This is a tubular metallic tie, somewhat oval in cross section and approximating the shape of an ordinary wood tie, but with a slot in its upper face extending from end to end, affording a certain degree of elasticity, Parallel transverse cuts are made where the rails cross, forming a tongue at each side of the slot, and the rails being seated on the tongues, where they are held by retaining shoes and bolts, the latter engaging a connecting plate on the under face of the upper section of the tie.

RAILROAD CATTLE GUARD.—Andrew J. Gwin, Minden, La. This is a gate-operating mechanism in which movable rails at the side of the traffic rails are connected with a vertically sliding gate, so that when a locomotive approaches the guard from either direction the gate will be depressed below the rails and held depressed until the train has passed, when the gate rises to normal position, to prevent cattle from passing along the track. The gate is arranged transversely of the track, cutting off the passage between the rails and also on each side, and it slides vertically in a box provided with suitable guideways.

Mechanical.

WRENCH.—Alf L. Winge, Miles City, Montana. This wrench has a toothed stock with fixed jaw, having a perpendicular gripping surface and a movable jaw embracing the stock, and having longitudinal sliding movement. The movable jaw has teeth to mesh with those of the stock, and a wedge slides between the movable jaw and the stock, to lock the jaw to the stock, while secured to the wedge is a spring catch under control of the operator, a projection on the catch engaging a recess in the jaw. The improvement affords a strong and simply made tool, the jaws of which may be quickly adjusted and locked.

Miscellaneous.

HELIOGRAPH ATTACHMENT.—Albert L. Wetherill, Philadelphia, Pa. A graduated segment is, according to this invention, mounted upon the mirror bar to turn with one of the mirrors carried thereby, the center of the segment coinciding with the pivot of the mirror, and a vernier being secured to the mirror bar. The improvement may be utilized as a range finder or for taking vertical and horizontal angles, the attachment being readily used for surveying purposes without interfering with the employment of the heliograph for transmitting flashes. The attachment may be readily disconnected and carried in the same pouch with the heliograph.

CARBURETOR.—Eugene M. Westcott, Hampton, Iowa. This is an apparatus to make carbureted air, to burn like ordinary illuminating gas, in which the depth of gasoline through which the air is forced may be readily controlled. Means are accordingly provided for regulating the air supply, and the apparatus is so constructed that it may be easily and thoroughly cleaned, and the water supply can be so regulated as to cover the distributer and prevent it from becoming clogged by freezing.

MAKING SULPHURIC ACID.—Peter S. Gilchrist, Charleston, S. C. This invention covers an improvement on apparatus formerly patented by the same inventor, and relates particularly to the construction of the columns or cases between the lead chambers, provision being made for their free expansion without breaking or buckling. The cross air pipes are also so arranged in the column that the pipes may be exceptionally strong, while effecting a thorough mingling of the gases passing through the column and collecting weak acid, which, coming into contact with the nitro-sulphuric acid formed on the surfaces of the pipes, decomposes the acid, thereby promoting and cheapening the process of acid manufacture.

PHOSPHORIC ACID WITH AN ABSORBENT.—Gaston Descamps, Havana, Cuba. This inventor has patented a new article of manufacture, a vegetable cellulose, as sawdust or cane bagasse, dried and charged with phosphoric acid, thus affording phosphoric acid in dry form, designed for use in the manufacture of sugar and other industries, and to be conveniently transported without deterioration.

SEPARATOR.—John E. Borchard, New Jerusalem, Cal. This is a machine for separating one kind of seed from another, and also for removing dirt and refuse. The seed are fed between oppositely revolving inclined rollers of different sizes, each roller having a different degree of inclination from the other, and the surfaces of the rollers being preferably roughened. The smaller roller, termed a guide roller, is concaved longitudinally, admitting of its being elevated at its lower end and yet leaving the space between the two rollers of a uniform width the entire length of their roughened surfaces, the guide roller then assuming a somewhat spiral relation to the periphery of the main roller.

MUSIC LEAF TURNER.—Cyril P. Brown, Spring Lake, Mich. According to this invention a wheel pivoted on a suitable case or frame carries a number of outwardly extending arms at whose ends are swinging fingers arranged in pairs, the apparatus being readily applied to a music stand, piano or organ, and the fingers being adapted to clasp the leaves, whereby they may be easily turned one by one without touching them with the hands. Any desired number of leaves may also be turned back simultaneously.

MUSICAL INSTRUMENT.—Evaristo Enriquez, San Juan Bautista, Tobasco, Mexico. This instrument has an elongated solid wooden body, mainly cylindrical, flattened on top and tapered toward the head, and there are frets on the top, strings fast at the head and keyed at the lower end of the body, with a removable peg at one side and a longitudinal pin at the lower end of the body. Music is made with the instrument by the joint action of the fingers, mouth and tongue, the melody, when played according to the design of the inventor, partaking of the nature of strains from a guitar and an Æolian harp.

FARM GATE.—James M. Hurst, Lucretia, Va. This is a strong and simple gate, mainly like the ordinary swing gate, but with means for latching it from top to bottom and a convenient lever for simultaneously operating the latches. The lever may also be operated by a person on horseback, and a guard is provided to prevent the lever from being moved by live stock. There are means for automatically closing and locking the gate.

METHOD OF CLOSING CANS.—John Banbury, Auckland, New Zealand. This is a method of sealing cans in which a wire is placed between the inner surface of the can body, just at its upper edge, and a narrow marginal upturned flange of the cover, and then applying pressure to bring the flange and the adjacent surface of the can body nearer to each other to hold the wire between them. To make an air-tight closure, solder or other sealing material may be employed, and one end of the wire has an outwardly extending loop, by pulling upon which the cover is loosened and the can opened.

NECK YOKE.—James S. Brown, Eureka, Cal. This is an improvement upon a formerly patented invention of the same inventor, the improved yoke admitting of a vertical as well as lateral movement upon the pole, whereby the neck yoke may be used with vehicles adapted for freighting or traveling over rough roads, promoting the comfort and proper working of the team.

TUG ADJUSTER.—Frank Sherry, Jacksonville, Ill. This is a very simple and durable device whereby the tug straps may be quickly shortened or lengthened as required. It consists of a base plate with an eye at one end to receive one end of the crupper and an opposite eye for one end of the back strap, while on the plate is a metal loop open at both sides and with a top opening, a bolt sliding on the base plate being adapted to enter the loop and force any straps into engagement with its top portion, the bolt being forced into the loop section when the straps have been properly adjusted.

TILE TRUCK.—Joseph W. Bienz, Rockford, Ohio. The cradle or bed, according to this invention, is hinged at one end to the truck proper, and is movable toward or from the truck at its other end, while a stay rod is jointed at one end to the cradle and hooked at its other end, the side pieces being hinged to the cradle, and a latch connecting and clamping the side pieces together. With this truck large tile, whether green or dry, can be handled by one man instead of requiring the service of two, the side pieces being removed in handling dry tile.

SHOE STRING HOLDER.—Henderson T. Small, Chanute, Kansas. This holder is adapted to receive shoe strings in assorted kinds and sizes, and so hold them that one or more may be withdrawn without disarranging the others, the improvement also forming a convenient display rack for the strings and a receptacle for quantities of strings in bales or bundles.

SUPPORT FOR CARDS, ETC.—William F. Jones, Baltimore, Md. This is a simple foldable support, readily adjustable to afford a firm, stable rest, for a card, or other similar article, so that it may be pushed back and forth upon a show case. It comprises a light frame held in inclined position by a base piece and jointed strut piece, a slotted keeper being arranged at the rear of the frame. The support may be formed in one piece, of cardboard or similar material.

TOY PISTOL.—Henry D. Medrick, Port Jervis, N. Y. In this pistol the hammer is moved entirely by the trigger, which automatically raises the hammer to firing position and releases it, when a spring acts upon it to force it against a cap to be fired. A tape of caps in the handle chamber is fed upward around the pivot of the hammer to engagement with the anvil, thus rendering the device a self-cocking and repeating, or rapid firing pistol.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention and date of this paper.

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NEW BOOKS AND PUBLICATIONS.

THE SENILE HEART. Its Symptoms, Sequelæ, and Treatment. By George William Balfour. New York and London: Macmillan & Co. 1894. Pp. 300. Price $1.50.

Much of this work is sad reading. It describes the heart troubles, one of the great dreads of humanity. It is, of course, especially designed for physicians, but to those who are willing to investigate these ailments, and are able to do so without being frightened by possibilities of disease, it will, no doubt, be found very interesting. A full index is appended.

A TEXT BOOK ON ROADS AND PAVEMENTS. By Fred P. Spalding. New York: John Wiley & Sons. 1894. Pp. viii, 213. No index. Price $2.

Good roads is to-day one of the subjects attracting the most widespread interest of the public. The fact is coming to be recognized that a civilized country should have the best possible roads and highways, and that the modern streets should not be disgraced by cobblestone pavements, and that the use of these inferior traction surfaces involves a great loss of energy in the conduct of everyday business. The different classes of pavements, such as macadam, asphalt, wood and stone block pavements, are all treated here in detail with numerous illustrations, and the work is in every way to be strongly recommended, except in the omission of an index.

GEOMETRY FOR GRAMMAR SCHOOLS. By E. Hunt. Boston, U. S. A.: D. C. Heath & Co. 1894. Pp. iv, 99. Price 25 cents.

SCIENTIFIC AMERICAN BUILDING EDITION.

OCTOBER, 1894.—(No. 108.)

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1. Elegant plate in colors showing a Colonial residence at Plainfield, N. J., recently erected for B. A. Hegeman, Jr. Two perspective elevations and floor plans, also an interior view. Cost $6,000. A picturesque design. Mr. Frank W. Beall, architect, New York City.
2. Plate in colors showing a very attractive stone dwelling recently erected for H. J. Peet, Esq., at Buena Park, Ill. Two perspective elevations and floor plans. A pleasing design. Mr. J. L. Silsby, architect, Chicago, Ill.
3. A dwelling at Bridgeport, Conn., recently erected for Frank Fowler, Esq. Two perspective elevations and floor plans. Cost complete $5,600. Mr. A. H. Beers, architect, Bridgeport, Conn.
4. A cottage at Stratford, Conn., recently completed for Robert Wheeler, Esq. Perspective elevation and floor plan. A unique design presenting pleasing elevations and a well arranged plan. Cost $6,200 complete. Mr. Edgar Osborne, builder, Stratford, Conn.
5. The residence at Belle Haven, Conn., recently completed for J. E. Kent, Esq. An attractive design in the modern Colonial style. Two perspective elevations and floor plans. Cost $6,850 complete. Messrs. Rossiter & Wright, architects, New York City.
6. A Colonial double house recently completed at Bayonne City, N. J. Perspective elevation and floor plans. Cost $4,800. Mr. Arthur C. Longyear, architect, New York City.
7. A dwelling at Bensonhurst, L. I., recently erected for John P. Jepson, Esq. An excellent example for a suburban home. Two perspective elevations and floor plans. Cost $5,620 complete, ready for occupancy. Mr. William H. Mersereau, architect, New York City.
8. A dwelling at Flatbush, L. I., recently completed for Richard Ficken. Esq. A design in the Colonial style. Two perspective elevations and floor plans. Messrs. J. C. Cady & Co., architects, New York City.
9. A small Colonial cottage at Bayonne City, N. J. Perspective elevation and floor plan. Cost complete, $2,800. Mr. Arthur C. Longyear, architect, New York City
10. A residence at Pompton, N. J., built for Wm. F. Hall, Esq. Cost, $7,500. A good example of an all-the-year-round residence.
11. The new Protestant Cathedral at Berlin, Germany, costing $2,400,000. Designed by Prof. Julius Raschdoff.
12. Roman remains at Bath, England.
13. The Temple of Neptune at Paestum.
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Notes & Queries

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

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(6282) G. C. asks: 1. What is the best constant current medical battery for burning out hairs, lighting a small lamp, etc.? A. Probably a storage battery is the best. For constant current a Daniell combination is good, but it is of high resistance and is not adapted to open circuit work. A Grenet or plunge battery is about the best primary battery for your work. Keep the zinc thoroughly amalgamated. 2. We have a battery of 12 cells made with a stick of carbon, a strip of zinc wrapped with cloth (to act as porous pot) and surrounded with broken gas coke. Would nitrate of silver in distilled water form a good working solution that would last and not polarize? A. No. It would be very expensive and would quickly polarize. 3. Can you mention a good work giving lots of information on primary batteries? A. We can supply you with the following books relating to the subject you refer to: Carhart's "Primary Batteries," price $1.50; Niblett's "Elementary Treatise on Electric Batteries," price $2.50. 4. Can you suggest a good solution for our battery, as sal-ammoniac does not answer? A. Try a mixture of 1 part nitrate of mercury and 2 parts sal-ammoniac with water.

(6283) H. E. writes: Why is it necessary to use such powerful engines to run dynamos? I cannot see why they should offer any great resistance, other than that caused by their great weight. A. A dynamo converts mechanical energy into electric energy. This it does by the forcing of the armature coils through a magnetic field. The resistance to its motion is almost identical with that offered by an armature of a magnet when drawn away from the pole of a magnet. The weight produces no resistance except as it increases journal friction.

(6284) F. G. C. writes: I have a telephone wire stretching from a pole to the house, a distance of 40 feet perhaps. It hums a great deal, and particularly at night and in cold weather. I have put an appliance called an anti-hummer or anti-singer at the house end of the line, but it does no good. Could you tell me, if I also put another anti-singer at the pole end, if it would help it? Also, what is the reason it sings in the night time? A. Try changing the tension of the wire. An intermediate insulator placed to one side of the center of the wire might answer. It hums when its natural period coincides in some way with the wind actuating it. The extra anti-hummer would probably improve it.

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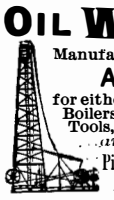
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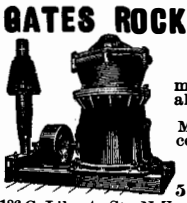
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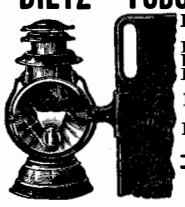
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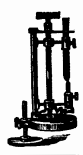
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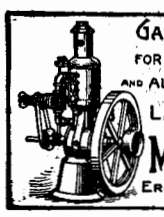
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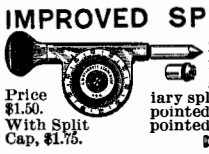
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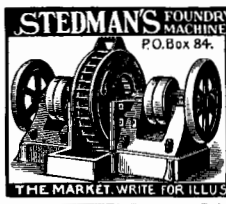
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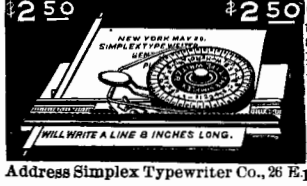

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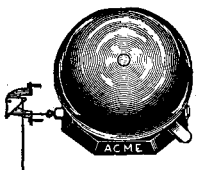

This is a call bell to call a servant from any part of the house, and is worked by foot, as shown in cut of dining scene. When in use it has a patent locking device to allow it to be raised above floor. When not in use it can easily be unlocked and allowed to be flush with floor, so it is out of the way for sweeping, etc. This bell is made in sizes from 3 to 7 in

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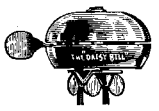

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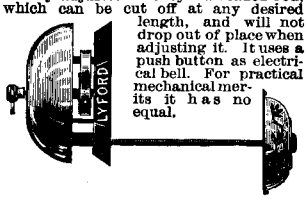
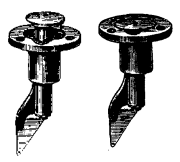
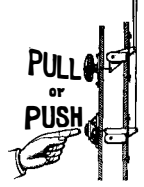
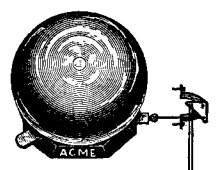


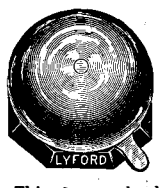


These foot push buttons show them open and shut. They have a patent locking device keeping them in place when in use or not. They are mortised in the floor. Nothing has ever been invented that meets the wants of the people as these do.





This is a long-ranged mechanical electrical bell, worked either by a push button or pull knobs; can be used in houses already wired without changing of attachments. It is the only practical long-ranged mechanical electrical bell ever invented. It is the wonder of wonders among house bells. Uses no batteries, has no grounding of wires or breaking of circuits. When once properly hung all care and expense ceases.



This shows a local bell wound from the base instead of from the center. They are made from 3 to 7 in. in diameter. No electrical bell can compare to them. They are clearer and more distinct in their uniformity of sound.

This shows a local bell wound from the center, showing the way it gets its power. They are made in sizes from 3 to 7 in. in diam.

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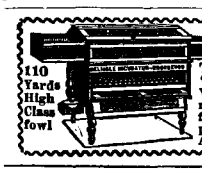

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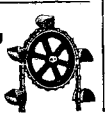

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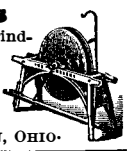

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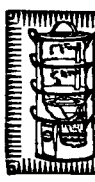

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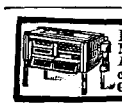

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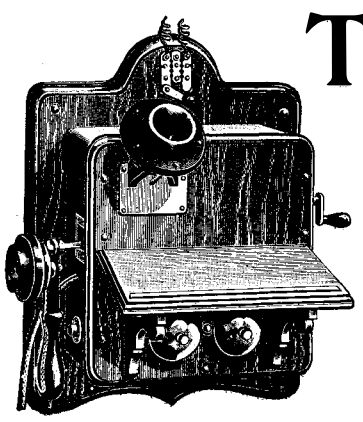

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Talks Long or Short Distances. Requires no Battery nor Induction Coil. Does not Infringe. Works on Ground or Metallic Circuit. Is Simple in Construction and Perfect in Operation. Nothing to get Out of Order. Conveys Speech Perfectly. Articulation is Clear and Distinct. Many Experts Pronounce it The Best.

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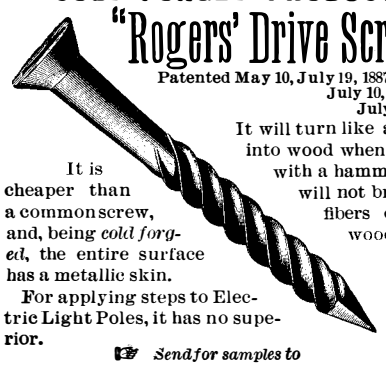

Patented May 10, July 19, 1887; July 10, 1888; July 19, 1892.

It will turn like a screw into wood when driven with a hammer, and will not break the fibers of the wood.

It is cheaper than a common screw, and, being *cold forged*, the entire surface has a metallic skin.

For applying steps to Electric Light Poles, it has no superior.

☞ *Send for samples to*

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By using our (stove pipe) **RADIATOR.** It has **120 Cross Tubes** where 4866 sq. in. of iron get intensely hot, thus making **ONE** stove or furnace do the work of **TWO.** Send postal for proofs from prominent men.

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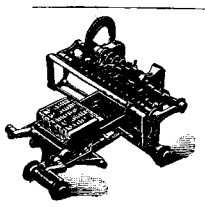

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The American Bell Telephone Company,

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This Company owns Letters-Patent No. 463,569, granted to Emile Berliner November 17, 1891, for a combined Telegraph and Telephone, and controls Letters-Patent No. 474,231, granted to Thomas A. Edison May 3, 1892, for a Speaking Telegraph, which Patents cover fundamental inventions and embrace all forms of microphone transmitters and of carbon telephones.

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Will work either wet or dry, and deliver a finished product. Capacity, 3 to 4 tons per hour on Phosphate Rock; 1½ to 2 tons per hour on Portland Cement, Quartz, or Ores, depending on hardness of material to be pulverized and fineness of product. Grinds from 30 to 250 Mesh with equal facility.

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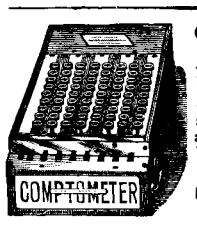

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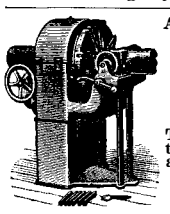

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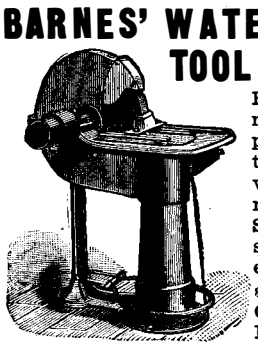

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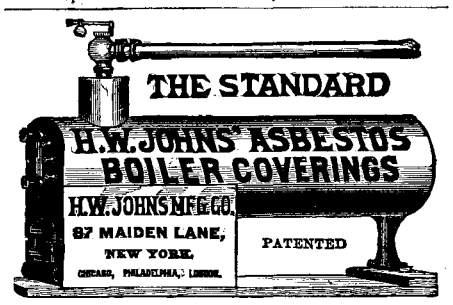

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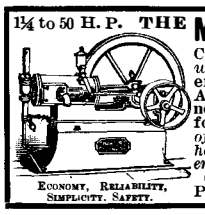

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